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Devoted to the interests of the engineers and technical officials of cities, counties and states

Vol. 75 No. 5

A. PRESCOTT FOLWELL, Editor

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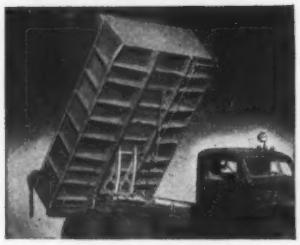

3. Typical installation for Six Wheelers.

4. Telescopic Hoist. Heavy-Duty Body.

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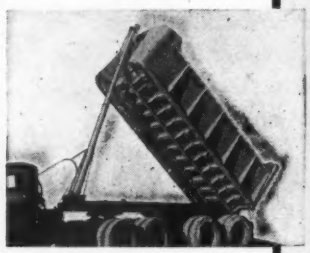

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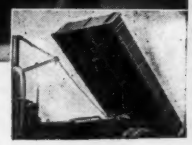

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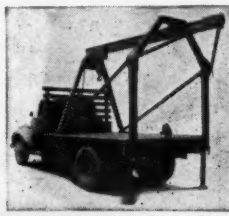
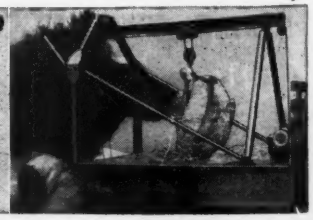


12. Tree-Moving Crane.



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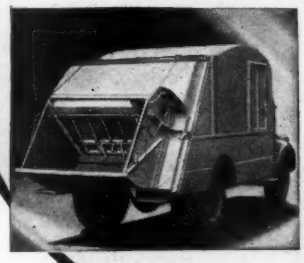

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WORLD'S LARGEST MANUFACTURERS OF TRUCK AND TRAILER EQUIPMENT

THE WAR EMERGENCY

Planning for Sewerage-Perfect Cities

A sewerage-perfect city might be defined as one in which every building is connected to a well-constructed sewer of ample capacity, and all the sanitary sewage is disposed of in a plant which produces an effluent satisfactory to the state board of health. Insofar as a community falls short of this, it fails to perform its full duty to its citizens and state.

There are few communities, we believe, that can not find herein some possibilities for postwar projects.

The American Road Builders Association and others interested in promoting highway work have been diligent in obtaining and placing before Congress data indicating the amount of such work needed to put all our highways into a first class condition. Congress should also be informed of the amount of work needed for providing first class sanitary facilities in all of our communities, in order that it may give adequate consideration to these also in such provision as it contemplates making for postwar work, either in the form of financial aid or otherwise.

With a view to obtaining data on which to base an estimate of such needs, PUBLIC WORKS is addressing a brief questionnaire to all city engineers, and a summary of the data so obtained and an estimate based upon it will be made public as soon as possible after receiving the replies to the questionnaire. It is hoped that replies may be received from all municipalities as promptly as possible.

New Order, L-41-e, for Highway and Street Construction

Conservation Order L-41 has been amended to exclude public highway and street construction under the jurisdiction of a Federal, State or other government agency, the War Production Board announced April 19th. Such construction will hereafter be governed by the issuance of a specially applicable order, L-41-e.

The basic construction order L-41 limits all types of construction work. Because of the differences of terminology employed in building and road construction, a special adaptation written to apply specifically to public highway and street construction in attaining the objectives of the basic order L-41 has been found necessary. The governmental agency responsible for the proposed construction must get permission from the War Production Board to begin the work, unless it is of a kind which does not require permission. This permission, generally known as an "authorization to begin construction," should not be confused with preference ratings or priorities. If a road project is allowed, either because it is not of the kind restricted by this order or because permission has been obtained, it may still be necessary to get preference ratings and allotments for certain materials which will be required. On the other hand, if preference ratings have been obtained or if materials are on hand, it may still be necessary to get permission to begin construction of the project.

Net Demobilization to Begin After July

Major General Hershey, on April 6th, said that demobilization began in 1940, but has been much more than offset by mobilization to date. However, the net mobilization is continually decreasing, and it is expected that by July demobilization and mobilization will be equal and remain so "until such time as the situation or circumstance permits or requires the demobilization of men in greater numbers than they are mobilized. When men are discharged more rapidly than they are inducted, or when they are discharged and no one is inducted, we shall have a descending curve in this mobilization-demobilization process, and then it will be recognized and understood that we are in fact demobilizing." However, it is expected that demobilization will be far more deliberate than it was after the previous war.

"The men demobilized should be released as near their homes as practical. The numbers discharged in any one area at any one time should be limited and should be based on the capacity of the community to absorb the numbers demobilized. The saturation point should be carefully observed and not passed."

Postwar Sanitation Construction Planned in California

A comprehensive survey of community planning in postwar sanitation systems and water works improvement has been completed by the State Department of Public Health of California. It was found that more than 20 per cent of 500 California communities surveyed report the need for postwar sanitary engineering projects. It is estimated that 228 such projects would be needed with an expenditure of $142,000,000 to be segregated as follows:

81 sewer systems	$53,476,946
32 sewage treatment plants	40,823,500
35 water development works	10,187,775
16 water treatment plants	5,977,000
64 water distribution systems	39,400,525

In addition, it should be noted that planning is completed or is in active progress for approximately $32,000,000 in postwar sanitary engineering projects. Financing for approximately $10,000,000 worth of this construction has been arranged. Many cities are still planning postwar activities and it is certain that several million dollars worth of additional work is in prospect. Some of the many State institutions will bring additional work following the war. Among the largest of these projects are the rehabilitation of the sewer systems and disposal facilities of Los Angeles, San Francisco and the East Bay district. The great increases in population within these areas have made all sewer systems and disposal facilities for these communities inadequate. In these three areas alone, approximately $85,000,000 must be expended out of $94,000,000 for the whole State.

WARD LaFRANCE TRUCK DIVISION

GREAT AMERICAN INDUSTRIES, INC.

ELMIRA NEW YORK

MEMORANDUM TO THE ADVERTISING AGENCY

FROM: A. Ward LaFrance, Vice President
Great American Industries, Inc.

SUBJECT: POSTWAR WARD LA FRANCE TRUCKS FOR FLEET OWNERS

As you know, there are some interesting, perhaps revolutionary, ideas under development here at our Elmira plant, and I know you can't wait to tell prospective users about them. That is understandable. But please keep this clearly in mind:

> Motor truck fleet owners are practical people. They are badly in need of replacement vehicles, and they are interested in the proved ideas which can be incorporated in trucks available just as soon as manufacturers can return to civilian production. We have some fundamentally important things to tell these gentlemen, so let's not waste paper on gaudy promises and fanciful pictures of beautiful, streamlined dreams of postwar models

Let's try to get the fact across that Ward LaFrance trucks have a twenty-five year reputation for being good trucks. Let's admit frankly that Army Ordnance engineers have increased our know-how and made it possibl for us to build still better ones after the last M-1 Heavy Wrecker has been delivered.

Fleet owners should be particularly interested in our new policy of concentration on their needs. This is of great importance because it will enable us to engineer and build vehicles to their exact needs. Fleet owners will recognize that this policy will result in a truck which will out-perform and outlive standard production models in a great majority of cases. Chances are, however, people will assume such trucks will cost too much. If you people in the agency can persuade fleet owners to get the facts from our engineering staff, that is all we ask of you. We can demonstrate clearly the fundamental economy of the new Ward LaFrance policy to any fleet owner's satisfaction.

A. Ward LaFrance

A. Ward LaFrance.

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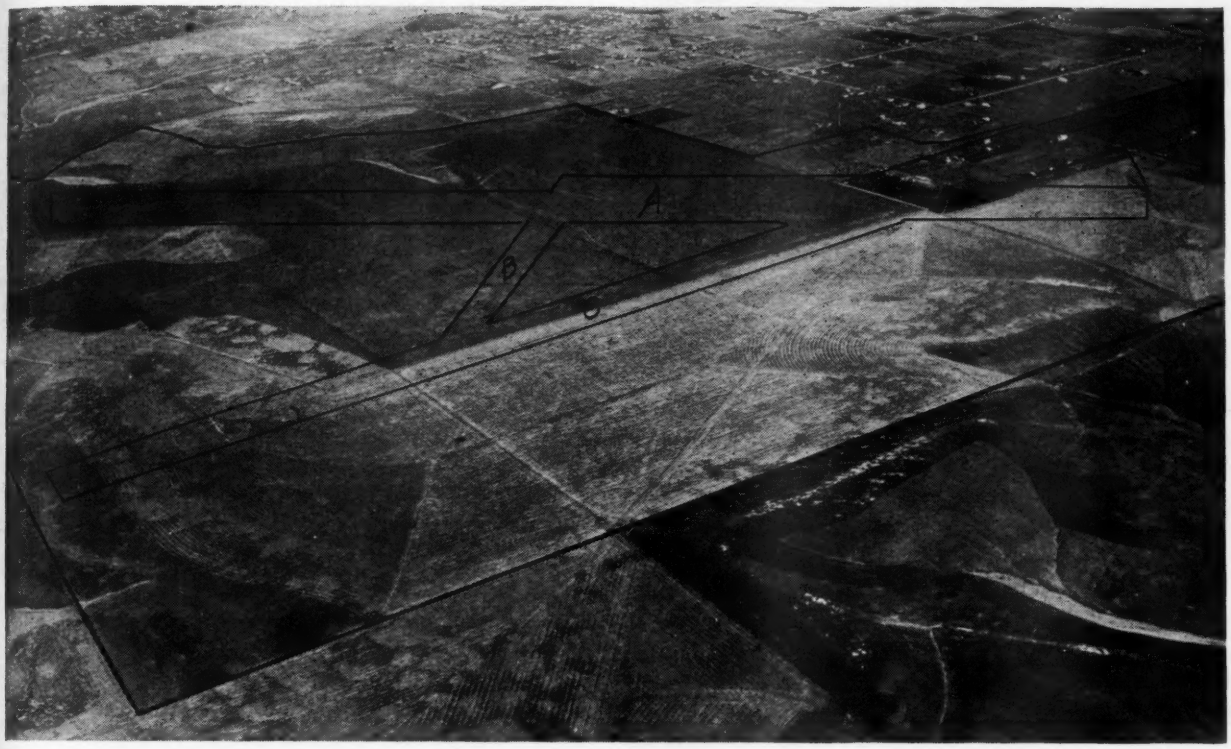


Airview of Lewiston airport site, looking north.

Building Lewiston's Million-Dollar Airport

Occupying 640 acres four miles south of the city, its construction involved excavating 100,000 cu. yd. of rock and 200,000 of earth. Work begun by WPA and completed by the CAA.

By W. P. HUGHES
City Engineer, Lewiston, Idaho

THE airport being completed at Lewiston, Idaho, is both strategically and picturesquely located 1400 ft. above sea level and 660 ft. above and four miles south of the city. Its construction involved a number of problems not ordinarily encountered in airport construction, such as the removal of 100,000 cubic yards of solid rock, orchards, homes, farms and pipe lines.

Lewiston, with a population of 11,000, is the largest city in north Idaho and the county seat of Nez Perce County. It lies at the confluence of the Clearwater and Snake rivers, at an elevation of 740 ft. above sea level, and is thus the lowest point in the state, which gives it a fine climate, semi-arid with low temperatures and with very little snow. The city is at the head of proposed navigation in a program planned by the Army engineers for building a series of low-head dams from Lewiston, down the Snake river, to the Columbia river at Pasco, Washington. This will make it the farthest inland port in the northwest.

The character of the country is rough and rolling and it was not an easy matter to find a suitable airport location to fit design and classification requirements necessary for post-war development. After consideration and inspection of several sites by city and C.A.A. officials, a site of 640 acres was selected four miles south of the city, partly in the Lewiston Orchards Irrigation District.

The original tract contained 525 acres of farming

Drainage ditch along the East-West runway showing character of material. All of this ditch had to be blasted.

Open 24-inch concrete storm drain at the shoulder of the NW-SE runway.

land. Later, with expansion of the port, it was necessary to buy an additional 115 acres, most of which was in an irrigation district consisting of cherry orchards and modern city homes. Due to the above factors, the burden of acquiring property was quite a financial strain on the community. Faced with these problems, the city secured the cooperation of the county, in order that finances would be assured. The property acquired cost $50 per acre on farm land, and from $200 to $850 per acre on orchard land, the total outlay reaching $68,794.46. The project required the removal of over 1500 cherry trees and six houses, which were sold to the highest bidder.

The plan was to build a Class III port, with 4,350-foot runways. The total financial outlay, as set up in agreement between the City-County and Civil Aeronautics Administration, was for an expenditure of $554,827, $134,523 of which was to be expended by the sponsor. When completed, the project will represent the joint cooperation of the WPA, CAA, the City of Lewiston and Nez Perce County.

The original work was begun by the WPA in March 1942. When the President ordered all WPA projects liquidated on February 1st, WPA had removed 100,000 cu. yd. of solid rock and 700,000 cu. yd. of dirt, and had installed three miles of storm drains; the work being about 80% complete and 90% of the paving material needed being on hand in stock piles. At that time the sponsors had expended around $140,000, with over $400,000 spent by WPA, or a total expenditure on that date of approximately $540,000.

Work Continued Under CAA

No time was lost in entering into negotiations with the CAA for its completion. The regional office at Seattle approved this request, which was later approved by Washington, setting up $241,000.

At this time the Navy became interested and requested the CAA to change and enlarge the design, and revised plans were completed after several months of negotiations increasing the runways to 5,200 feet, with a 5,000′ x 150′ paving strip in center of two 500-foot wide runways. There are 9,000 feet of taxiways, graded 100 feet wide with a 50-foot paving strip. This enlarged plan required additional funds amounting to $244,000, or a total of $484,000, all of which were set up by the CAA.

On August 10, bids were received in Seattle. The Northwestern Engineering Company of Rapid City, S. D., was the lowest of ten bidders, their bid amounting to $447,199.80, and they were officially awarded the contract in September. Work got under way soon thereafter, with 150 working days stipulated as time to complete the job.

The second chapter in the construction of the expanded project to be completed by the Northwestern Engineering Company, under the CAA, consists of the following design:

Design: Two 5,200-foot runways with a 5,000′ x 150′ paving strip down the center. Runway "A," as shown on diagram, is northwest and southeast, which is the prevailing wind direction. Runway "C" is east and west. Runway "B" is southwest and northeast, and will be graded on that section between runways "A" and "C." Runway "A" is on a 1.5% grade line, while "C" is on a broken grade line of maximum .6 of 1 percent. Quantities are pretty well balanced, although, due to the necessity for excavating much solid rock, there will be some excess material. Slopes vary from 5 to 1 to 3 to 1, and on the ends of the runways 20 and 40 to 1. The highest fill is 22 feet. Excavation at southeast of "C" runway was, in places, 18 feet. It was at this point that most of the solid rock was encountered.

Quantities

The work done by the contractor included the following:

Excavation: 165,000 yards of earth excavation
60,000 yards of solid rock excavation

With the exception of a possible 50,000 yards of solid rock crushed for paving base, all excavated materials were hauled a mile to the new end of the runway "C."

Drainage: 13,408 feet of concrete, bell and spigot, sealed-joint pipe 8″ to 18″ in diameter
2,072 feet of 24″ split pipe gutter tongue and grooved type
1,530 feet of 8″ and 10″ pipe installed by WPA to salvage
37 new manholes
17 reconstructed manholes
49 drop inlets

Pipe 12″ in diameter and larger was specified to be culvert pipe, with the following minimum requirements:

RD-8 tractor and bulldozer attachment.

Inside Diameter	*Min. Shell Thickness*	*Min. Ultimate Strength lbs./lineal ft.*
12″	1¾″	2700
15″	2″	2800
18″	2¼″	2900

Of over 10,000 cubic yards in ditch excavation, 50% was solid rock and had to be shot. Drainage work was sub-let to Roy Bair of Spokane. Three ditchers were used on this work, one of the clam-shell type and two ¾-yard shovels. Cranes attached to trucks were used for lowering pipe. The maximum depth of ditches was 22 feet.

EQUIPMENT

The contractor used the following equipment on this work:

3—D-8 Tractors with 23-yard Le Tourneau scrapers
2—D-8 Tractors with 12-yard Le Tourneau scrapers
1—D-8 Tractor with 19-yard Le Tourneau scrapers
1—D-8 Push cat and dozer
1—D-7 Pulling tandem sheep foot roller
2—No. 12 Patrols
1—Le Tourneau ripper
1—48″ Adams elevating grader and 25 trucks hauling 150,000 cubic yards, approximately 5,000 feet.

NOTE: This Adams grader loaded a four-yard truck in two minutes, or about 2,500 cubic yards per ten-hour day.

Road drilling equipment consisted of two 180-cubic foot compressors with three to five jackhammers, and two automatic wagon drills, the two latter averaging 330 lineal feet each in a ten-hour day.

An Iowa crushing and screening plant, with 10 x 36 inch jaw crusher and 18 x 30 inch rolls for crushing gravel, and a Lippman 18 x 36 inch primary with capacity 100-tons per hour was used in conjunction with the plant when crushing solid basalt from runways.

Equipment for stabilizing the runways consisted of two No. 12 patrols and one No. 11 patrol, two pneumatic-tired rollers and two steel rollers.

The paving plant consists of one Madsen 3,000 pound plant and a Jaeger bituminous paver with capacity of 75 tons per hour.

The WPA had placed 19,200 tons of paving rock in stock piles and this was supplemented by 4,300 tons under Northwestern Engineering Company contract, with an additional 2,900 tons of material to blend with WPA stock in order to meet CAA specifications. In addition to the above, the contractor had to add 17,000 tons of one-inch mixers for leveling course.

The contractor was compensated for his low bid on rock excavations, due to an excess of material on project enabling him, under the specifications, to utilize rock excavation for ballast, or leveling course aggregate.

Plant Mix Asphaltic Concrete Surface

The specifications required that the bituminous surface be of the plant-mix type, 2″ in thickness, placed on runways and taxiways. The bituminous surfacing

RD-8 tractor attached to 18 yd. carryall.

Excavating shot rock, in 15-ft. ditch for storm sewer.

Drainage ditch, E-W runway.

was to be of one course and be sealed and made impervious to water with a seal coat of R.C.2 asphaltic road material and screenings or sand. The placing of the wearing surface on the prepared base course, or sub-grade, is preceded by the application of a "prime coat" of kerosene cut-back M.C.2 asphaltic road oil.

Concrete Apron. A six-inch Portland cement concrete apron 150 x 200 feet was approved by the CAA. after the main project was let. The money has been appropriated, but the contract is yet to be negotiated.

Ballast Base Course. A portion of the eight-inch ballast course installed under WPA called for reprocessing prior to placing of the remainder of the base course or leveling course, bladed into windrows, and the subgrade exposed, compacted to a minimum density of 90 percent, as determined by the Modified Proctor Density A.A.S.H.O. Method T-99. The specifications on base course calls for three-inch minus or sieve designation as follows:

Sieve Designation	*3″ Maximum*
3″	100%
2″	65-100%
1″	45-75%
No. 4	25-50%
No. 40	10-25%
No. 200	3-10%

Leveling Course. This consists of two inches of hard, durable particles or fragments of stone or gravel, mixed or blended with sand, clay or other similar blending or filler materials, and may be crusher run with 100% passing a one-inch mesh screen.

It is estimated the work will be finished ready for use by June 1st. Buildings are under consideration but will be held in abeyance until use of same is more definitely established.

The personnel was as follows: Oliver Bandleman, Resident Engineer CAA; Wm. P. Hughes, City Engineer, Rep. City & County; Dale Kenaston, Project Manager, N. W. Engineering Co., and Ed. Roach, Grading Supt., N.W. Engineering Co.

Charges for Out-of-Town Sewer Connections

Lexington, Ky., receives $6,500 annually from sewer rental charges levied on owner or occupant of each building outside the city limits using the municipality's sewer system. Fees range from $4.80 a year for a three-room dwelling to $9 a year for a 10-room residence and $4.20 for each unit in an apartment building.

M. S. A. hydrogen sulphide detector.

Gas Hazards

By A. ELLIOTT KIMBERLY
Principal Assistant Engineer, Ohio Department of Health

WITHIN every sewerage system and within closed structures at all sewage treatment works, oxygen deficiencies, or poisonous or explosive gases may ever be present. Every manhole is a potential death trap; sewage gas in underground structures or otherwise confined, if mixed with air, may explode or oxygen deficiency may cause asphyxiation which will not respond to resuscitation.

Manhole Fatality at Willoughby. Ohio has experienced a number of fatal accidents attributable to the presence of toxic gases or to oxygen deficiencies in sewer manholes or in pits or underground structures at sewage treatment works. The most recent Ohio accident occurred last July (1943) in Willoughby, Lake County, where two men lost their lives in a sewer manhole. A maintenance crew responded to a report of a stoppage near the end of an 8-inch sanitary sewer, the upper manhole of which was about ten feet above a lateral serving a local restaurant.

One of the men entered the manhole with a flushing hose, suffering no discomfort; however, when the force of the water had removed the obstruction, a large volume of gas entered the manhole, causing his immediate collapse.

A second member of the crew, believing that his co-worker had a heart attack, with no protection and without safety belt or ropes, attempted a rescue. He, too, immediately collapsed.

The fire chief, responding to a call from the foreman, put on a smoke mask and also attempted a rescue. The chief also became unconscious, but fortunately precaution was taken to place a rope sling underneath the chief's arms and he was immediately pulled out of the manhole and soon recovered. The other two men could not be revived. A representative sample of the gas in the manhole showed on analysis 8.80 per cent carbon dioxide, no carbon monoxide, and 8.20 per cent oxygen. Oxygen deficiency was obviously the cause of both deaths.

Since the accident the village has available for instant use an approved fresh air mask with blower.

Sewage Ejector Tragedy at Cambridge. Due to sewage gas, hydrogen sulphide, or oxygen deficiency, on October 4, 1928, two employees of the City of Cambridge lost their lives and a third narrowly escaped death in a 21-foot deep pit of an abandoned sewage ejector station.

The ejector station was built in 1912, but was operated for only a relatively short time. At the date of the accident, sewage flowed by gravity into a local creek through a 12-inch drain. The sewage flowing in a 10-inch sewer reduced to 6 inches at the pit, splashed onto the pit floor from a height of 5.5 feet. The sewer served about 500 residences and a factory with 400 employees. Due doubtless to the reduction in diameter at the pit, stoppages were frequent, demanding periodic attention by the sewer maintenance crew.

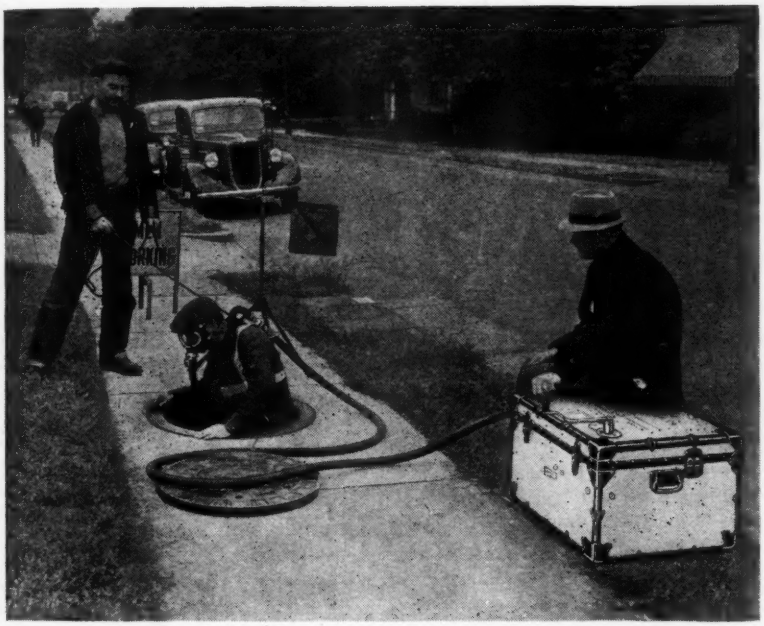
Such a situation developed the day before the accident and a foreman was directed to remove the stoppage, first ventilating the pit as much as possible and permitting no one to enter without wearing a safety rope.

On the following day the obstruction had been cleared, but before leaving the work a lantern was lowered into the pit to ascertain whether the sewage was flowing in full stream. One of the men descended part way into the pit but was suddenly overcome by gas and fell to the floor, fracturing his skull on a steel beam located about seven feet above the bottom of the pit. The city's director of service, wearing neither a mask nor safety belt descended to the bottom of the pit to assist the fallen man, followed

M. S. A. all-service gas mask.

ewerage Systems and Treatment Works

Fatal accidents in Ohio, their causes, and precautionary measures recommended for preventing accidents where dangerous gases or oxygen deficiencies may exist.

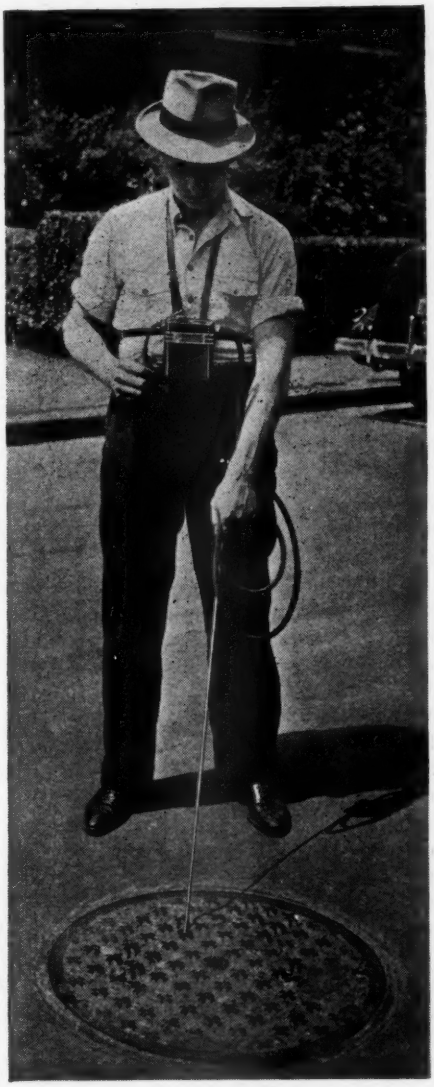


Using hose mask and blower in low-oxygen atmosphere.

directly by two laborers who, however, stopped at the steel beam level. In the meantime, other men had lowered a rope which the director attempted to place around the shoulders of the fallen man, but before accomplishing such result the director fell forward unconscious. Practically at the same moment, one of the laborers standing on the steel beam also collapsed. The second man was able to struggle up the ladder (14 feet) and reported the accident to the chief of police, who was requested to send help with gas masks.

Protected by a safety rope and wearing a World War I canister gas mask, a member of the fire department entered the pit, tied a rope around the third man who collapsed, and lifted the director out of the sewage which was a few inches deep. The fireman reached the top of the pit safely.

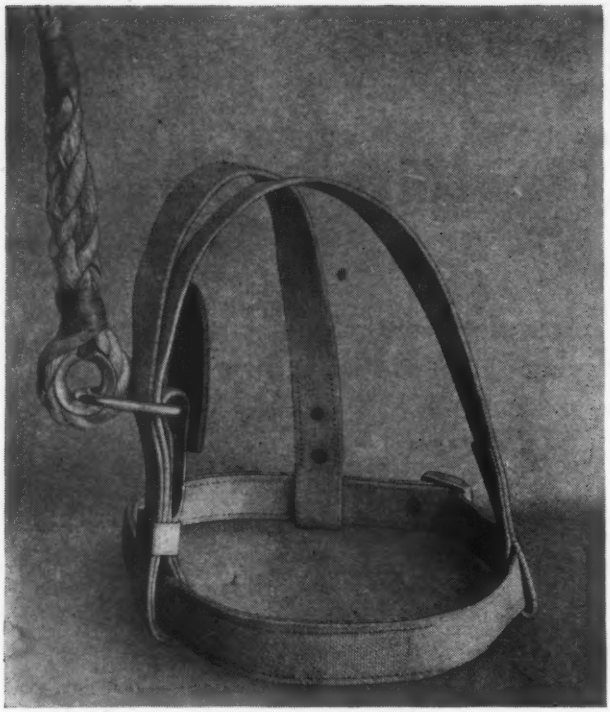
At this juncture, the chief of police called for volunteers but, before volunteers could be obtained, a local physician arrived and without protection of any kind descended the ladder, tied a rope around the director, who was raised from the pit and rushed to a local hospital. The third man could not be resuscitated and he died in about two hours. Before ascending to the surface, the doctor ascertained that the first man was dead.



Using Explosimeter to test gas in sewer.

Apparently the cause of the tragedy was hydrogen sulphide in substantial concentration, as determined later when the sewer again became clogged.

Since 1928, it is stated that no city workman is permitted to enter a manhole without a safety rope and hose mask with blower. As of the date of the accident, the city was obviously entirely unprepared to handle gas hazards in sewer manholes or in other underground structures in which the gases produced



The M.S.A. safety belt.

by the decomposition of sewagic material must always be assumed to be present.

Fatality in Sewage Pumping Station at St. Marys. On July 12, 1921, two men lost their lives attempting to make repairs to pumps in the St. Marys pumping station. The station substructure includes a dry well 21 feet below grade, access to which is by a steel ladder through a floor opening ordinarily closed, and housing two vertical motor-driven pumps discharging to a common force main. The pump discharges were not equipped with check valves although gate valves were installed on the pump suctions.

At the time of the accident, it became necessary to repair one of the pumps and because of the absence of check valves, it was the practice to close the pump suction valves and remove the plate on the clogged pump, thus permitting the sewage in the discharge line to drain into the pump pit, usually creating a pool from 24 to 30 inches deep. Before starting repair work the pit was pumped dry with a hand pump operated from the superstructure floor 21 feet above.

Following such procedure two men had climbed out of the pit and had started the hand pump. One of the men noticed a board floating on the water and, lest it might be drawn over the suction of the hand pump, again descended to the sewage pump level. He collapsed, however, practically at the bottom of the ladder. The second man immediately called the director of service, who was outside the building, and forthwith descended in an attempt to rescue his partner.

The director of service, watching from the pumping station floor, noted that the second man also became unconscious, and started down the ladder himself. After descending five or six feet, the director became dizzy, returned to the floor of the pumping station and, although partially overcome, had sufficient strength to shout an alarm. A responding fireman, using a World War I gas mask, was able to rescue the two men. Both men had been in the pump pit about an hour before release, but neither could be resuscitated. The cause of death as reported was oxygen deficiency due to carbon dioxide.

Since this accident, gate and check valves have been installed on the discharge lines from both pumps and the city has purchased a blower for use whenever it becomes necessary to make pump repairs.

Fatal Accident at Sewage Treatment Works at Lima. A fatal accident, similar to that in West Virginia, occurred at the Lima sewage treatment works in May 1932. The scene of the accident was a sludge sampling manhole constructed alongside a separate sludge digestion tank. At the time of the accident, the digester was completely filled with sewage sludge and supernatant liquor. The sampling manhole was equipped with a hinged cover and cast-iron manhole steps, but provided with no ventilation.

A works operator entered the manhole to collect sludge samples but was overcome by gas and fell from the top of the manhole, cracking his skull. A consulting engineer at work some distance away attempted to rescue the operator but he too was overcome. Both men were later removed by firemen wearing gas masks. The operator was revived but died of a fractured skull. The engineer could not be resuscitated.

The works had no hose masks, no safety belts, no ropes, and no sampling manhole ventilation, either natural or artificial, and yet in the manhole frequently entered there was periodically present a poisonous gas in sufficient concentration to asphyxiate.

The lesson to be learned from this fatal accident is to be prepared with safety equipment and always to assume that toxic gases or oxygen deficiency exists in underground structures at sewage treatment works.

Sewage Gas Explosion at Sewage Treatment Works at Dayton. The explosive power of gas from decomposing sewage organic matter is strikingly illustrated by an explosion at the Dayton sewage treatment works in November 1938 (See PUBLIC WORKS for January, 1939.)

The explosion occurred between two batteries of imhoff tanks in a covered pipe gallery housing sludge, water and sludge gas piping, and connected at both ends to control houses in which were electric motors and various control devices. The force of the explosion carried sections of the concrete gallery roof as large as 12′ x 150′ x 8″ thick, a distance of from 60 to 75 feet. The explosion occurred at about 5:00 a.m. and fortunately there was no loss of life.

Investigation indicated that sewage gas from U-tube slurry traps entered the gallery and was subsequently exploded by sparks from an experimental single phase motor.

Again, the remedy is, in part, ventilation either natural or forced for all underground structures at sewage treatment works. Obviously there should be no smoking around sludge digesters or other devices where sludge gas may be present.

In reconstructing the gallery, blower equipment was installed with provision for automatic operation upon entrance. In rebuilding the imhoff tanks after the explosion many safety features were incorporated in the design. Certain of these safety measures are of such general applicability that mention of their salient features appears advisable; namely, (a) replacement of gas collecting domes by "floating covers"; (b) water seals for sludge gas set on floor stands, seals serviced by city water pressure; (c) collection manifold constructed of spiral welded pipe, with Dayton couplings, in lieu of the original bell and spigot cast iron pipe; (d) gas compressor capacity increased, excess gas automatically vented and burned; (e) all electrical wiring and equipment of explosion-proof

(Continued on page 42)

Economy of Rehabilitating Rockford's Wells

Shooting the six wells in sandstone once in six to eight years effected an annual saving of nearly $5,000 in cost of coal consumed in pumping.

H. S. Merz

By H. S. MERZ
Superintendent of Water Department, Rockford, Ill.

ALL of the water supply of Rockford, Ill., is obtained from six wells 1300 to 1600 ft. deep in the Cambrian sandstones, which are pumped with air. Wells Nos. 1-4 were drilled in 1920-'22, when the plant was constructed; Nos. 5 and 6 were drilled in 1926. These wells were spaced too close together (see map) and interference developed. (Records indicate that wells in this locality placed about a mile apart can be pumped at a rate of 3 mgd without interference.)

For several years these six wells were pumped at a rate of 6½ mgd, which lowered the general groundwater table to such an extent that the increased lift necessitated considerable more coal consumption, the consumption per million gal. pumped rising from 2.65 tons in 1924 to 5.6 tons in 1932. Part of this, however, was due to plugging or sealing of the pores in the sandstone, and shooting of wells Nos. 1, 3 and 4 in 1933 reduced coal consumption to about 4.2 tons, after which it rose to 5.65 in 1941. In 1942 wells Nos. 2, 5 and 6 were shot, and coal consumption reduced to 3.85 tons. The policy now is to pump at about a 4 mgd rate, which apparently is holding the static levels constant and indicates that the "rate of recharge" is not being exceeded.

Based on previous experience of this city, the effect of shooting lasts 6 to 8 years, when it should be repeated. Comparing the cost of coal in 1942, before shooting wells 2, 5 and 6, with that in 1943 after their rehabilitation, we find a decrease from $16.60 per mg to $13.10, or a yearly saving of $4900, which would pay the cost of rehabilitation in 26¾ months.

After the rehabilitation of wells 2, 5 and 6 they were tested to determine the pumping conditions that would give the maximum economy for each well. These were determined to be as follows:

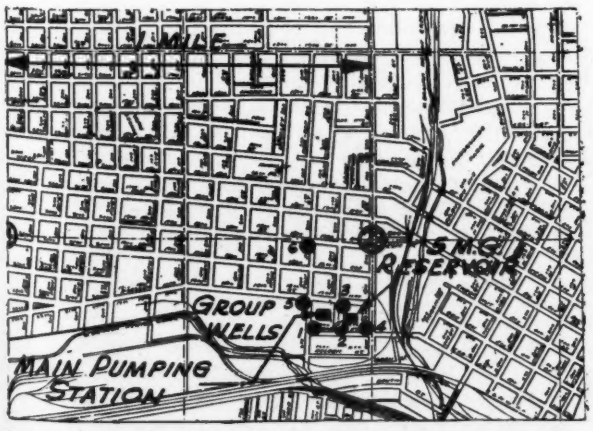
Final adjustment of pumping conditions for maximum economy.

Well No.	Static depth	Drawdowns	Running submergence	Total Lift	% Submergence	Discharge Gallons/min.	Remarks
2	26′	64.09	244	93.8	72	1438	Test data 1922-3.2 tons coal per m.g.
2	70′	42	222	129	63	840	Test 8-24-'43-3.85 tons coal per m.g.
5	73′	30	238	125	66	705	" " " "
6	32′	53	238	110	69	1220	" " " "

Adjustment of air lift wells on 8-24-'43 is made so that lift is kept as low as possible by controlling drawdown. Compressor pressure of 120#/in. is limiting factor as regards lowering of single air line. Note that static depth of water level fell at Well No. 2 from 26 ft. in 1922 to 70 ft. in 1943.

Contracts for rehabilitating wells 2, 5 and 6 provided that each should be shot with 50 lb. to 200 lb. charges of 80% nitroglycerine; Nos. 2 and 6 in Mt. Simon sandstone at depths of 900, 1000, 1125 and 1175 ft.; and No. 5 at 650, 850, 900 and 1100 ft. in the Galesville, Eau Claire and Mt. Simon sandstones, until a maximum of 650 lb. had been used. The wells were then cleaned out to the bottom (1500 ft. depth), approximately a half car load being removed from each well; the air piping was reinstalled and each well pumped to waste for 8 hr. to obtain yield and drawdown data. Then the air lines were removed, the well cleaned out again, and the air lines reinstalled and adjusted to obtain 60% submergence for efficient pumping.

An electric log was run of well No. 5 while it was being repaired, the contractor for the repair having been in the employ of the State Geologic Survey at the time. The well was calipered and the shots showed up as cavities better than 3 ft. in diameter and 50 to 60 ft. long. The report from the State is not yet available, so that the effect of the shots as regards flow of water into or out of the shattered strata in the well is not available.



Map of part of Rockford, showing main pumping station, wells and reservoir.

Unusual Subaqueous Pipe Repairs

Deepening of channel necessitated lowering of pipe, for which none of the commonly used equipment was available, so trench was made with water jets and an air-lift pump.

By HARRY U. FULLER
Chief Engineer, Portland Water District

IN 1929, the Portland Water District laid an 8-inch submarine line between Mackworth Island and Great Diamond Island in water reaching a depth of 18 feet at low tide. The Metropolitan joint cast iron pipe was laid in a trench excavated 5 feet deep in the clay forming the harbor bottom.

For four years there were no leaks, but since then the line has been a constant source of trouble and expense. Thirteen times in the last 9 years leaks have necessitated the placing of new sleeves or the caulking of old ones.

Last summer, the U. S. Government dredged a channel 450 feet wide crossing this line and to a depth that would leave part of the line too high. The Government dredge left a 20-foot ridge in which this line was buried and ordered the obstruction to navigation removed. Extra depth was dredged on both sides of the ridge into which the clay could be scraped.

The Islands are about 1½ miles apart, and the location of this work was a long way from either shore. In order to be able to find the job on arrival in the morning, ranges, consisting of several pieces of 1-inch pipe driven into the mud and lashed together at high water mark, were placed at each end of the line and provided with a flag and lantern. These were often run over by military boats and had to be replaced.

A large part of the leakage had occurred in this particular part of the line and it seemed that if it could be replaced with another type of pipe, future troubles might be less. It was found that 500 feet of 8-inch screw jointed pipe could be bought and the decision was made to remove the old pipe and replace it with this type of pipe at a greater depth.

Because of war conditions, all equipment that might normally be used for such a job was working for the military services and the problem here was to get the results with what was available. The entire organization of the Water District had some part in the job, and outside of some floating equipment and a large air compressor, which were hired, made the apparatus and did the work.

Capt. Whitney's lighter, 18 x 50 feet, equipped with a derrick and hoisting engine and twin propulsion engines, became available and was used throughout the job. Capt. Bowker's powerful motor boat was used for towing the pipe and carrying men. Capt. Greenlaw's small motor boat was used for running anchors and running errands. Two other lighters were used to support the pipe while it was being towed to the job.

The work to be done consisted of several distinct jobs. First, it was necessary to remove 4 feet of clay that covered the pipe, and then the old pipe must be taken up. Next, a trench must be excavated at a greater depth. Then the new pipe must be screwed together on the Falmouth beach, floated out to the job and lowered into the trench. Next, the ends of the new pipe must be connected to the ends of the old pipe with split sleeves. Lastly, the ridge of clay must be removed, filling the new trench, and the surplus going into the adjacent low places.

How this was accomplished was an interesting illustration of applied hydrostatics and hydraulics.

A large "snow plow" built of oak, well reinforced with iron and weighted with about 500 lbs. of extra iron, was pulled along the line of the pipe by the lighter, and removed the clay so that the diver could fasten a chain around the pipe and then the lighter derrick hoisted the old sections of pipe to the deck.

Four split sleeves were found in a row connecting five pieces of pipe, showing that a considerable part of the leak trouble on the line was concentrated in this one place.

The next move was to excavate a trench, and as no equipment was available to operate a bucket, it was decided to try digging the trench with water jets and removing the clay with an air lift pump. This seemed to be possible because the material to be moved was blue clay of somewhat the consistency of butter or cheese.

This air lift tool consisted of pieces of 8-inch galvanized pipe screwed together to a length of about 40 feet. Near the bottom of this pipe, a piece of 16-inch pipe 8 inches long, with top and bottom plates, was welded, forming an air chamber around the pipe. Five 11/16-inch holes in the 8-inch pipe admitted air from the drum. A piece of 2-inch pipe to carry air was welded to the drum and ran up outside of the 8-inch pipe nearly to its top.

On the other side of the 8-inch air-lift pipe a 3-inch water pipe ran down to the bottom and its lower 5 feet consisted of nipples 8 inches long with connecting tees. Into each tee was screwed a jet nozzle consisting of a 4-inch long nipple flattened at one end to an opening of ½-inch and curved to form an eighth bend. It was found that jet nozzles around the bottom of the air lift improved its work and that one-inch jets were better than 2-inch. The resulting trench was 3 feet wide and 5 feet deep.

To provide power to operate this air-lift trencher, two gas-driven air compressors with a combined capacity of 300 cu. ft. per minute were placed on the deck of the lighter and connected to the air pipe on the trencher with air hose.

To provide water for the jets, a gas-driven water

(Continued on page 46)

A close-up of Oscar at work.

Patching Gravel Roads With Next To No Help

By D. R. SAVAGE
Engineer for Aitkin County, Minnesota

CONDITIONS as to highway work in Aitkin County, Minnesota, were described in PUBLIC WORKS for June 1943. Briefly, the county is about 12½% farm land, the rest is cut-over pine forest. Long stretches of road extend through conservation and state lands on which no taxes are paid, and taxes can be counted on only from the farms and resorts around our lakes. Allowing for delinquents, we obtain about $18,000 to $20,000 in taxes for the road and bridge fund for maintaining about 475 miles of county roads; and naturally lean very heavily on State Aid and Gas Tax funds. Even with these we have to be "penny pinchers" and study how to make a dollar go the farthest possible.

In the past, little grading was done. Roads had been "graded" for $84 a mile, including a smoothed surface between two V-ditches in an out-to-out width of 36 ft. Occasional culverts were put in as need developed. Considerable gravel was hauled on and compacted by traffic, ruts being leveled occasionally.

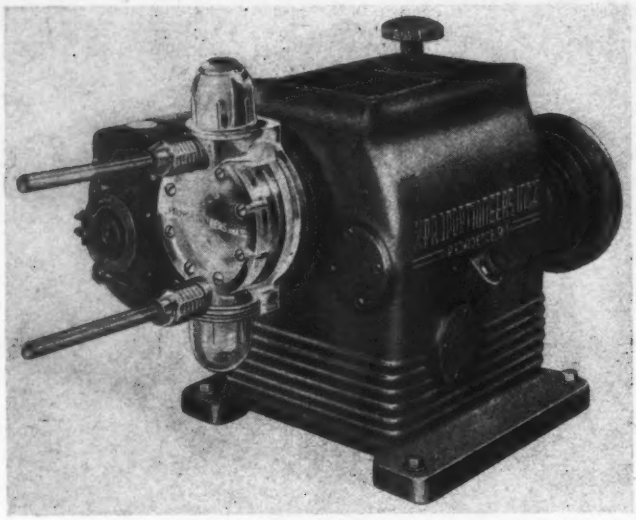
Naturally, bad spots developed which neutralized the good of the whole road, and these formed bottlenecks which have received our chief attention. Two Caterpillar patrols are used to bulldoze the slightly high places into the low ones. The aim has been to form ditches 3 ft. below the road grade and 8 or 10 ft. wide, enough to hold most of the snow; the dirt from these being used to raise the grade a foot above the adjacent fields so that they would blow clear of snow; the roadway being 24 ft. wide. In addition to the two graders we hire two root or stone pickers.

This grade is graveled 20 ft. wide, using 500 cu. yd. to the mile, letting traffic pound this in; then another 300 to 500 cu. yd., according to the soil. In some cases, a third coat is added a year or two later.

Help is scarce these days for loading the gravel trucks, and our men created "Oscar" (see photograph). They said "Let there be a gravel loader" and there was a gravel loader. Oscar was made of scrap, welding rods, bright ideas and spit, combined in varying proportions. He is not pretty but he works. For instance, the patrolman will hitch Oscar behind his truck, drive out to the gravel pit, spot his truck, start Oscar up, and in fifteen minutes drive off with two yards of gravel. Not bad, eh, for a fatherless orphan! He is not patented.

Grading just finished with power patrol.

Chemical Treatment of S



Proportioneers Heavy Duty Chem-O-Feeder.

MANY sewage treatment plants are overloaded due to increased population, war-time industrial plants, or both. Restrictions on the use of critical materials and other difficulties in construction preclude improvements to plants in many cases. Little construction and equipment are required for the use of chemicals, in some cases none at all, and such use can be of material help in alleviating many such difficulties.

Chemical treatment may be used with primary treatment plants to effect material improvement in the quality of the effluent. While most applications have been on sedimentation tanks equipped with mechanical sludge-removal equipment, there seems no reason why chemical treatment cannot be used advantageously with Imhoff tanks. Where there are trickling filters, the employment of adequate chemical treatment in the primary settling tank reduces markedly the load on the filters and may permit the production of a good effluent even though the plant load is considerably over design capacity.

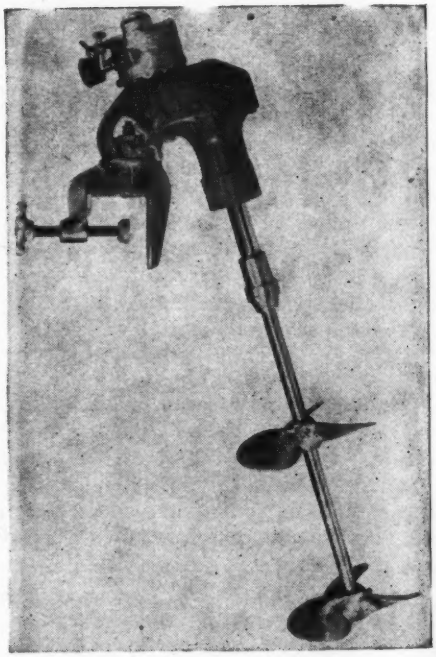
Results That Can Be Attained

A well designed plant can be expected to remove from 70% to 78% of the BOD in the primary tank if the chemicals are correctly and effectively employed. Even haphazard use of chemicals will result in removals of 45% to 55% of the BOD. Suspended solids removal is usually about the same. One result of good chemical treatment should be a clear and sparkling effluent—in itself a good advertisement. However, the appearance is deceptive, for such a nice-looking effluent nearly always carries a heavy BOD punch.

In summary, a well-operated plant of good design, using chemical coagulation effectively as an aid, should produce a primary tank effluent having a BOD of around 60 to 90, provided the raw sewage is in the BOD range 275-375.

Chemicals Used

Alum and Ferrisul have many advantages for war-time use. Neither requires any complicated chemical feeding equipment, and installation of the equipment needed is not costly. A dry-feed machine (perhaps a spare one from the water plant, or obtained through Medical Aid, the City Lease-Land) is needed. If a dry-feed machine cannot be obtained, alum can be fed as a solution. The writer does not have available at the moment data in regard to methods of using Ferrisul other than by dry-feeders, but believes the manufacturers (who can be contacted direct or through the Editor of this magazine) can furnish information on simple procedures to meet nearly any condition. In all cases, it will be wise to seek the advice of the chemical manufacturer and also to confer with your State sanitary engineering department.



Air-driven portable mixer. Mixing Equipment Company.

Essentials in Good Operation

Sludge Digestion.—The use of chemicals increases quite markedly the amount of sludge produced, but at some plants (not at all of them) chemical sludge appears to digest as well as or even better than other sludge. However, if your sludge digestion tanks are already loaded to the limit, careful consideration ought to be given to the matter of sludge disposal before spending money and time on chemical treatment. It is not worth while to improve your primary and perhaps secondary treatment at the cost of having your digester give trouble. Moreover, in most plants the digester supernatant is discharged into the primary tank and if there is a considerable volume of strong supernatant from a poorly operating digester entering the primary tank, the chemical coagulation process will normally

f Sewage As A War-Time Aid

Correct use of chemicals will generally increase capacity of sedimentation tanks, and so of trickling filters or other secondary treatment. Suggestions as to chemicals to be used, and how, and under what conditions such use is advantageous.

be upset. In such a case, no good at all will have been accomplished by chemical treatment, and perhaps some ill.

If the only difficulty is deficiency of sludge drying bed space, and there is available sufficient digestion capacity, drying can be expedited considerably by adding an alum or iron solution to the sludge as it is discharged onto the bed.

In summary, check your sludge situation carefully. If satisfactory digestion is impossible, there can be no hope for successful use of chemical treatment for the reasons given above. Before giving up, however, look around for secondary storage or other means of taking care of your increased sludge load.

Mixing and Flocculating.—In using chemicals, some mixing and flocculating is needed, the amount depending to quite an extent on the characteristics of the sewage. Some careful jar test tryouts should be made with the help of your state sanitary engineer and a representative of the company furnishing the chemical Don't make these tests on Monday, when the sewage is commonly unusual in quality, or on any other day when you have reason to believe this to be the case. Leave the exceptionally difficult periods for solution afterward and aim first at meeting your needs for perhaps 80% or 90% of the time.

Over-and-under or around-the-end baffles will probably be sufficient for mixing and flocculating, but conditions will differ materially from one plant to another. The initial mix should be vigorous but not violent for perhaps 5 minutes, followed by 15 minutes of progressively more gentle mix. These time figures are not exact; each sewage must be considered separately, and allowance should be made for extended flows above the average.

Flocculation tanks at Toledo, O., equipped with Link-Belt slow mixers.

In many plants a concrete, masonry or even timber mixing tank can be constructed in close proximity to the settling tank, and the mixing baffles installed in it. In a few cases, where the settling tanks are rectangular, it may be possible to utilize the inlet end of the tanks for the mixing unit, fitting it into the space between the chains and the scrapers. This will take careful figuring and manipulation. Settling periods in primary tanks can be reduced somewhat if a good floc is formed, so the loss of settling capacity caused by this construction will not be serious.

More serious will be the loss of head through the mixer, which may amount to 3 or 4 inches. The grades into and through the plant must be checked carefully to determine where this extra head can be obtained. Sometimes it will be available; sometimes a short section of the sewer above the plant can be relaid on a flatter grade; perhaps the outlet weir can be lowered slightly; or other alternatives may be available.

Based on a 20-minute period of mixing, and an average flow of 1 million gallons per day, the mixing tank would need a capacity of around 1875 cu. ft., or, with allowance for above-average flows, at least 2000 cu. ft. Provision of this inside a settling tank already fitted with sludge removal equipment will be difficult, but may be possible.

Settling Period.—A settling period of 1 hour should be ample if there is a good floc. Some plants with detention periods of only 35 to 45 minutes have worked well, but a longer period is better. The coagulated sewage should be discharged into the settling tank with as little agitation and disturbance as is reasonably possible, though excessive precautions are not necessary. A pump should never be used to handle the coagulated sewage. One advantage in having the mixing device in the settling tank is that it insures the entrance of an undamaged floc into the tank.

Chemical Dosages.—Generally speaking, it is not possible to obtain good results in chemical treatment

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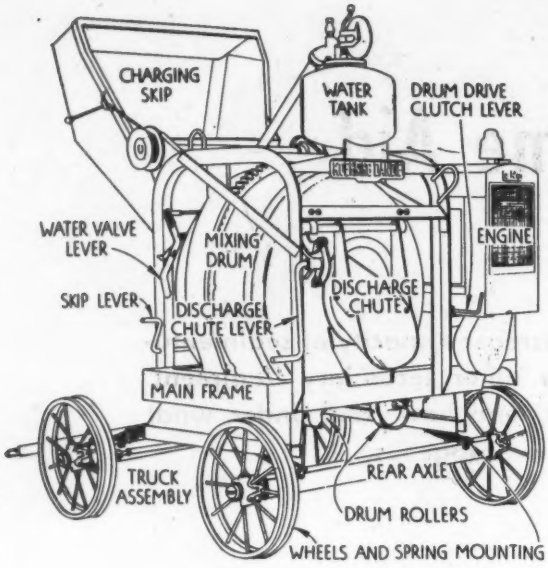
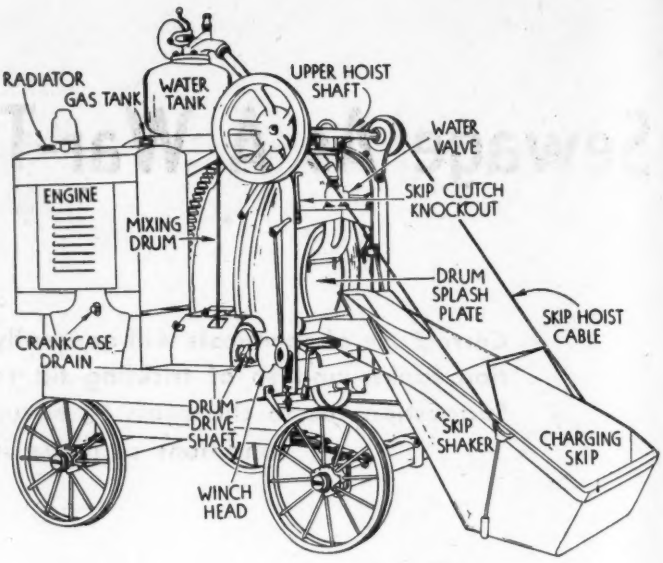


Discharge side of mixer.



Charge side of mixer.

Care and Maintenance of a Concrete Mixer

Instructions for cleaning mixer after each day's operation, lubricating, storing it between jobs, and starting it when put into use again.

EVEN such a rugged piece of equipment as a concrete mixer needs care, if it is to render long and satisfactory service; and also maintenance to compensate for the wear it undergoes. A clean machine is much more likely to receive proper lubrication. If concrete is allowed to accumulate on the mixer it eventually will obstruct the lubrication fittings, retard the action of the working parts and cause excessive wear. It is common practise to coat the working parts and especially the drum with form oil (as used for coating concrete forms) or waste oil, such as is drained from the motor. This will prevent concrete from sticking to the paint or bare steel. To clean the mixer after the day's operation, wash it well with hose pressure water. Knock off the portions of concrete not removed by the washing action. Do not pound the skip or drum shell. Scour the mixing drum with gravel or stones and water before shutting down at noon and night. Allow the scouring action to continue for at least five minutes. Discharge the gravel or stones and flush the drum interior with water.

STORING THE MIXER: At the end of the season, or between jobs, the mixer should be stored in a dry, protected place. Never leave the machine exposed to the elements. The following procedure is to be observed if the mixer is to be stored for thirty days or more. The lubrication precautions should be repeated every three months thereafter. Knock off accumulations of concrete and wash down the whole machine thoroughly. Lubricate all bearings. Cover bare steel parts with oil or grease. The charging skip and charging skip hoist cables must be thoroughly and carefully covered with grease or heavy oil. Drain the water-measuring tank and valve. Make sure all water is removed from the drum. Drain water from engine cooling system which has two drain cocks, one located at the lower right corner of the radiator and the other in engine block on mixer drum side. Drain the fuel system — tank, lines, carburetor and strainer. A gummy substance will form if the gasoline is allowed to stand in these parts. This gum accumulates in the carburetor and in the carburetor jets and passage, and will result in serious trouble. When necessary these gum deposits can be dissolved with a solution of one part alcohol and one part benzol, or acetone. After the engine has cooled, remove the spark plugs and pour ¼ pint of lubricating oil into each cylinder. Crank the engine (with switch in OFF position) two or three revolutions to distribute the oil over the cylinder walls. Replace the spark plugs. Cover the exhaust pipe and air intake to prevent moisture from entering the engine.

STARTING MIXER THAT HAS BEEN IN STORAGE: The mixing drum and its related parts usually require little attention. However, there are certain precautions that need to be followed in regard to the engine. Remove the spark plugs and pour a mixture of one part gasoline and one part light lubricating oil into each cylinder—one tablespoonful per cylinder is enough. Crank the engine rapidly for several revolutions—this will blow excess oil out of the spark plug holes and wash old oil from the valves and pistons. This also tends to loosen any tight piston rings. Install spark plugs. Fill the crankcase with

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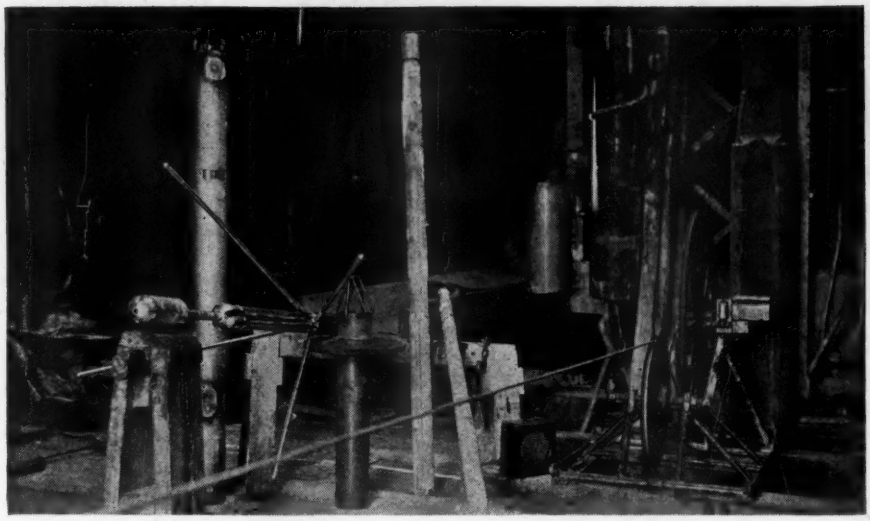


Instruments used in subsurface surveys — hole caliper, cable for running tools into well, depth-measuring device and others.

Application of Geophysics to Groundwater Problems

A brief description of recent developments in the methods used by the Illinois Geological Survey in investigating groundwater conditions, especially in "logging" wells. Condensed from a paper before the Annual Water Conference, Engineers Society of Western Pennsylvania.

By Carl A. Bays and Stewart H. Folk
Geologist and Engineer, and Associate Geologist, respectively, Illinois State Geological Survey

APPLIED geophysics — the practical use of geophysical principles — has experienced phenomenal growth within the past several decades. Thirty years ago geophysical investigations were confined to the realm of "pure" science and to exploration for metalliferous deposits. Today various geophysical methods are used in exploration for groundwater, petroleum, coal, sand and gravel and many other non-metallic minerals as well as the metallics, and in investigations of geological and engineering problems arising from drilling for and producing water, oil and gas, and in constructing dams, highways, airports, and buildings.

All these and other fields of investigation have contributed to present methods and techniques of geophysics, but because of the large financial returns in the petroleum industry, it has been there that applied geophysics has made its greatest advance in recent years, particularly in subsurface or well surveying. Groundwater work, like other provinces of engineering, can profit from adaptation of new developments in all scientific and industrial fields, but it can benefit most from the advancements made in the petroleum industry where the problems are so similar and the progress so great.

Geophysical methods have proved successful in locating groundwater supplies and in solving many of the problems that arise in drilling, completing, and producing water wells. The geophysical surveys made of Illinois water wells and research in groundwater geology have furnished much factual material that, when properly integrated, usually permits sound interpretation of groundwater phenomena and subsurface conditions. Such knowledge can be used for remedying many of the defects in old wells and for planning more intelligent development of groundwater resources in the future.

As the investigations are continued it is expected that many of the questions in geophysical surveys and interpretations will be answered, and that new techniques and instruments can be developed for solving other problems in groundwater work, not only in Illinois but in the many other areas where the same or similar problems are encountered.

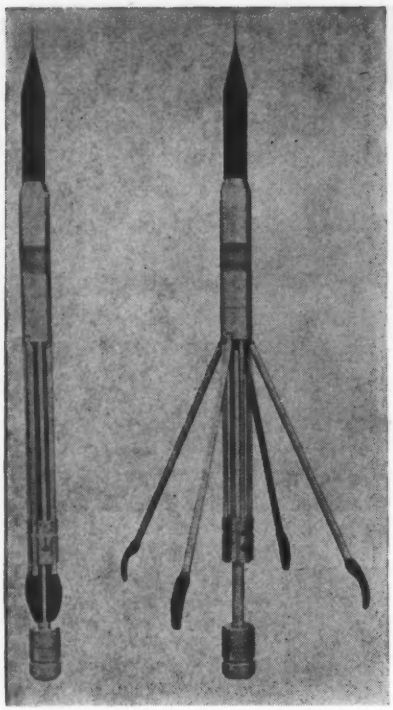
Geophysical Methods Used in Groundwater Work

A large share of all geophysical exploration, and of course all groundwater exploration, is conducted for the purpose of determining the conditions beneath the earth's surface. Toward that end there are two approaches: (1) surface surveys, made on top of the ground; and (2) subsurface surveys, made in wells or boreholes and mines. Almost all the methods and techniques of geophysics have been tried and many of them have been found successful in groundwater work, but the electrical methods receive the widest application in both surface and subsurface surveying at the present time.

Surface Surveys

Most surface surveys in groundwater work are made to locate groundwater supplies. Electrical resistivity, electrical potential, magnetic, seismic, gravitational, thermal, radio, and radioactive methods have been used for that purpose with varying degrees of success by a number of organizations and individuals in many different areas.

The Illinois Geological Survey has found that measurements of the earth's electrical resistivity



Hole caliper. At left, caliper closed for lowering into well. At right, caliper opened, the arms maintaining contact with the sides of the hole as the caliper is drawn up.

(earth-resistivity surveys) are very useful in locating water-bearing sands and gravels, and for the past decade has employed such surveys extensively in groundwater exploration in Illinois.

A modified Gish-Rooney circuit is used by the Illinois Geological Survey in its earth-resistivity surveys. Two steel electrodes are driven into the ground some distance apart and two copper electrodes are set between them. An electrical current (commutated D.C.) is passed through the ground between the steel electrodes, and the potential drop across the space between the copper electrodes is measured. The apparent resistivity of the earth to a depth approximately equal to the distance between the copper electrodes can then be calculated. The depth of investigation is varied by changing the spacing of the electrodes. Measurements of resistivity to great depths can be made by this method, but because the water-bearing glacial and fluvial sands and gravels in Illinois occur at less than 300 feet below the surface, deeper measurements are seldom made by the Geological Survey.

Of course some knowledge of the subsurface geology is essential for the proper interpretation of the electrical data in any area.

When a survey has indicated the presence of water-bearing deposits, locations are recommended for test-drilling so that samples of the sand or gravel and water may be obtained before the producing well or wells are drilled.

Subsurface Surveys

Electrical resistivity, electrical potential, thermal and sonic methods have been used in surveying or "logging" water wells. Helpful auxiliaries, although not strictly geophysical instruments, are devices for measuring the hole diameter from top to bottom of the well, for measuring the rate of flow of fluids throughout the well bore, for testing each formation separately as drilling progresses, for sampling the water at different places in the well, and for taking pictures of the walls of the hole both above and below the surface of the water. Some of these were developed originally for use in water wells but most have been borrowed from the oil fields. There are a number of other geophysical methods and auxiliary instruments now used in oil and gas wells that would be of value in water wells. These include seismic, magnetic, radioactivity, neutron-bombardment, fluidopacity, and hydrogen-ion concentration surveys, devices for shooting bullets that perforate steel casing and shatter sandstone formations, and devices that take formation samples from the wall of the hole after a well has been drilled. Other methods and instruments which give promise for use in both water and oil wells are in the experimental stage, and there are in view still others that have not yet reached the drawing board. The use of any or all of the above methods and tools in surveying wells is known as "geophysical logging."

Surveys of deep water wells in Illinois now include most or all of the following logs: electrical log, comprising the electrical potentials and resistivities of the formations and their fluid contents; electrical resistivity and temperature of the fluid in the well bore; rate and direction of fluid movement in the well bore; hole diameter; additional potential and fluid resistivity logs run after dissolving salt in the water; and additional potential and temperature logs run while the hydrostatic head on the formations has been increased by flowing water into the well. The data available from geological investigations, particularly the study of well cuttings, and the results of the geophysical surveys are integrated to answer the questions and solve the problems presented by most wells.

The essential elements of a logging unit are: a cable which bears one or more insulated conductors, for running the tools into the well; a winch for spooling the cable; a measuring device for accurately indicating the logging depth; the instrument panel, on which are mounted the galvanometers and other apparatus that are necessary for the measurement of the various parameters investigated by the logging tools; a recording device, usually a camera, by which the logs are recorded on photographic film or paper; and the tools themselves. Some of the most commonly used tools are the electrical logging electrode, hole caliper, well-surveying thermometer, current meter, and the "salter," a device used for dissolving salt in the water throughout the well.

Electric Logs. The electric log consists of curves or logs that represent the apparent values of the electric potential and electric resistivity or impedance of the wallrocks and their contained fluids throughout the uncased portions of a well. Measurements of potential and resistivity are made with a traveling electrode assembly which incorporates one or two current electrodes and several pick-up or potential electrodes spaced at different intervals, and with a circuit so designed that both potential and resistivity values can be measured and recorded simultaneously. Both curves are recorded and printed on the same strip, the potential in a column at the left and the resistivity in a column at the right.

Fluid Temperatures. The principal use of temperature logs in oil wells has been to locate the approximate top of cement behind the casing; the method is based upon the fact that the heat generated during the setting of the cement produces a marked increase in temperature of the fluid within the casing at the top of the cement. Temperature logs have been used for the same purpose in a few water wells and undoubtedly will be so used to a greater extent in the future, because the advantages of cemented casing are now recognized, and more and more casing strings are being cemented.

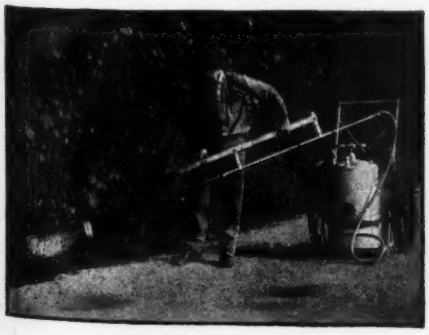
(Continued on page 48)

Spraying roadside slope with diesel oil preparatory to burning. Simplified adjustable boom equipment is operated by one man from front of tank truck.

Controlling Roadside Vegetation

Use of torches, spraying and disking on California highways under wartime conditions. Spraying is considered the most desirable, with disking as the best substitute where practicable.

THE California Division of Highways in the 1920's began an active program of controlling the fire hazard presented by growths of grass and weeds between the traveled lanes of its highways and the adjacent lands where grain fields, timber lands and water sheds would be threatened by fires accidentally started by passing traffic. Every year since then has seen extension of the program and improvements in methods used, until by 1942 it had expanded to nearly 2,600 roadside miles and cost $118,179. Due to conditions imposed by the war, the program for 1943 was reduced to 1,980 roadside miles and $86,000.



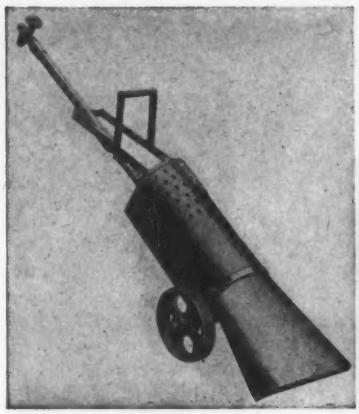
Littleford Weed Burner.

At first the work was largely confined to hand removal of brush, hoeing around posts and dry burning. Dry burning (after the growth had reached maturity and dried) was dangerous to fences and the growth beyond them and damaged roadside trees, and was practically abandoned for spraying with substances that would kill the growth quickly so it could be burned while the crops were still green. Experiments with use of large hooded burners and with live steam did not work out favorably.

Spraying

Undoubtedly the best results were obtained with diesel oil, sprayed under pressure of 30 to 50 lb. per sq. in., sufficient to insure penetration of heavy growth; using .05 to .10 gal. per sq. yd. Ten or 15 days after it was sprayed, a strip could be burned easily, with little danger of fire spreading beyond the sprayed area. In fact, if applied while the growth was still small, it killed it completely and burning was not necessary. To spray and burn a strip 9 ft. wide cost, in 1942, an average of $53 a roadside mile.

To minimize the cost, spraying was restricted to areas adjacent to grain, grazing and water shed lands, where there was considerable tourist travel—local residents were naturally careful not to start roadside fires.



Soper weed burner.

Courtesy Standard Steel Works
Soper coilless torch.

Where there were wide, clean shoulders, the danger of fires starting was considered slight and no treatment necessary; but where vegetation grows close to the pavement edge the hazard is much greater.

In 1942 the strip to be sprayed was moved in from the area adjacent to the right-of-way line to the nine feet next to the improved shoulder. This permitted more rapid work, eliminating pauses to swing the boom or spray bar to clear the posts and trees, and permitted the equipment to keep to the traveled way or improved shoulder, and so operate while the soil was soft. This also did not leave a burned strip like a scar through the wild flowers and green growth, but the strip looked like a part of the roadway. Most important, being located where most fires start, it was a fire preventive rather than a fire break.

Improved spraying equipment was developed in 1942. One improvement consisted of a folding swivel-toggle boom, mounted between the cab and the tank, with a pressure pump at the side or rear of the truck. The boom is operated by one man sitting on the right side of the driver's seat, where he can see ahead and regulate both boom and truck movement.

Another development used a single pipe toggled in sections, which served both for the boom and also for supplying the oil to the spray heads, thus eliminating the oil hose. When not in use in moving from point to point, the boom is folded away behind the cab, and when the spraying has been completed for the season it is easily dismantled and stored.

Disking

Even with these improvements, spraying is expensive, and in 1942 537 miles of fire breaks were made with farm-type disks, which cost $15 a mile, compared to $53 for spraying and burning. Disking, however, is not possible on steep slopes of cuts. In level valleys, disking is begun as soon as the ground dries out sufficiently to carry the equipment, using a heavy disk, with retractable rubber-tire wheels which can be lowered for rapidly towing the disk behind a truck from job to job.

Shoulders on slope areas inside the gutter or ditch line are seldom disked, as this would disturb the compaction of the slope or shoulder and make probable its early displacement by wind and rain. On such areas, grading equipment can be used to advantage, one blade width bladed directly next to the strip normally bladed for shoulder maintenance establishing a satisfactory fire break.

With war restrictions limiting the use of diesel oil, it may be necessary to return temporarily to dry burning with torches, in which cases water sprays should always be used to limit the spread of the fire. The high-pressure spray rigs used for tree spraying, which will throw a spray of 25 to 30 gpm 100 ft. up a slope, could be used for this purpose.

Another possibility is use of soil-sterilizing and growth-killing chemicals. But chemicals based on arsenical compounds should not be used because of danger to livestock; chlorate compounds cause too great a fire hazard; and other types are too costly to use over large areas.

This article is adapted from one by E. S. Whitaker, assistant landscape engineer, in *California Highways and Public Works,* official journal of the California Division of Highways.

Chemical Treatment of Sewage as a Wartime Aid

(Continued from page 21)

while trying to save money on chemicals. Many of the negative and mildly favorable reports on treatment with chemicals are the result of trying to save a few extra nickels by cutting chemical dosages. If improved treatment is really needed, a couple of dollars a day for an adequate chemical dosage will not send any community into bankruptcy.

A good basis for starting dosages for jar tests is 4 grains per gallon or about 560 pounds per million gallons of sewage. A strong sewage with high alkalinity may require 6 or 7 grains per gallon. Such strong sewages as many communities have on Monday may require 25% to 40% increase in dosage above the average.

Reduced pH and alkalinity result in a lower required chemical dose. Adding acid to reduce alkalinity is not practicable; too much acid is required on the basis of cost and it may affect the operation of the digester. Recirculating the effluent of the primary tank (when alum is used as a coagulant) may help, if the tank has sufficient capacity, but this will not usually be the case if chemicals must be used to relieve an overload.

When digester supernatant is returned with the raw sewage, more chemical—a lot more—will be required, and even then poorer results will be obtained. It is better to treat supernatant in some other way, or to return it into weaker night flows.

General.—Records of pH and alkalinity taken at frequent intervals during typical days and underlined with red or green to indicate poor and good operating results form a fairly reliable guide to the need for increase or decrease of chemical dosages.

Don't mess with chemical treatment unless you need it; if you do really need it, put your Scotch instincts in the sub-cellar and use enough chemical to get the results that chemical treatment can give if given a chance. There is, however, a decided limit to the benefits that can be obtained by increasing dosages, and some sewages just can't be overpowered; but few have reached that limit. Chemical treatment is not cheap; neither is it costly, when compared to other methods on the basis of depreciation, obsolescence and fixed costs, and when considered on the basis of temporary emergency use. If it rains for two weeks and the creek is high, cut out chemical treatment entirely; but when you need it, the best rule for operation is to use enough to get good results. At the end of the year you will be surprised how little it has cost you.

THAT BRIDGE OF TOMORROW CAN BE *planned* TODAY

As a highway or municipal engineer you have a double responsibility. Not only will you want to make your plans to provide jobs for returning service men and war workers, but these plans must fit a postwar world, the pattern of which is not yet clear.

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Other advantages include ease of transportation, quick assembly on the job site without special equipment, and freedom from maintenance.

Include ARMCO Multi Plate in your postwar plans even though you may not be able to get it for your immediate construction needs. After the war it will again be available for bridges, stream enclosures, large sewers and special drainage structures. Write us for complete data. Armco Drainage Products Assn., 35 Curtis St., Middletown, O.

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Care and Maintenance of a Concrete Mixer

(Continued from page 22)

the correct amount of the specified lubricating oil. Remove covers from exhaust pipe and carburetor air inlet. Fill the water cooling system with clean water. Fill the fuel tank with clean gasoline.

LUBRICATION: Be certain that the mixer is properly and thoroughly lubricated. Oil all clevis pins and joints with lubricating oil. Check the oil level in the engine crankcase. See that it is filled to the correct level with the correct grade of oil. Check the oil level of the gear reduction case. Complete lubrication instructions and chart will be found in instruction booklets.

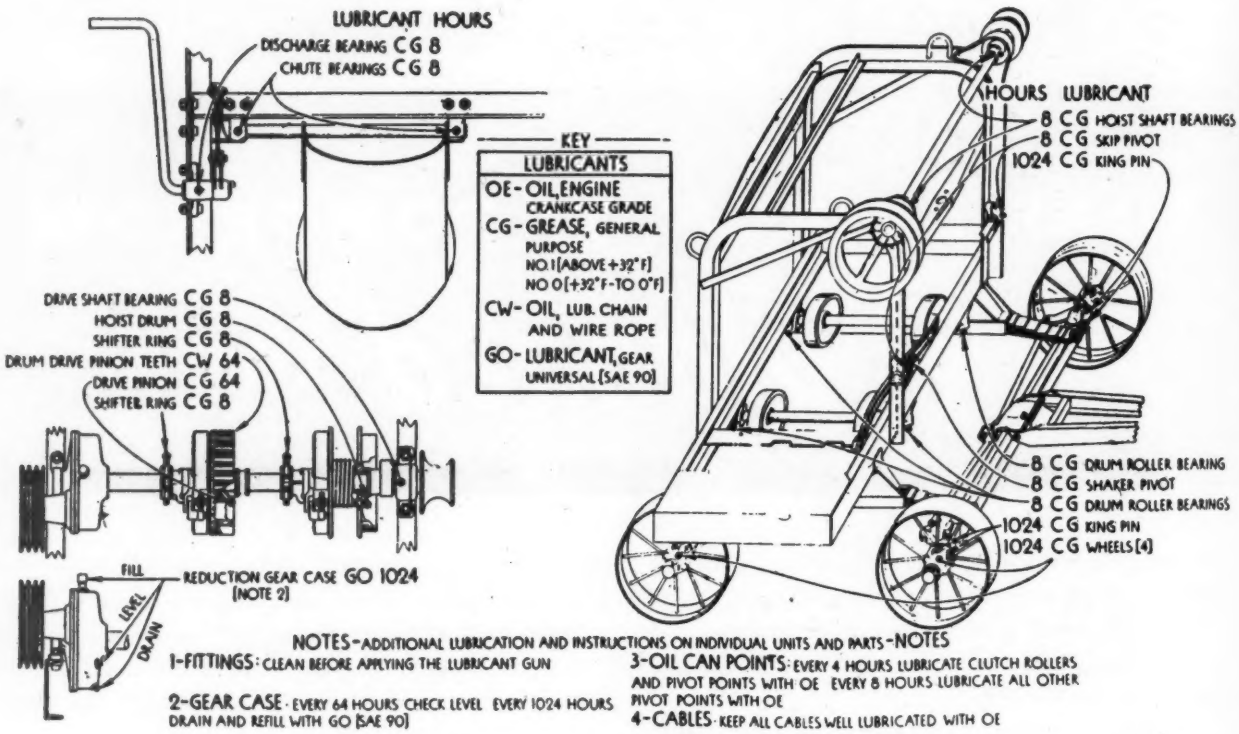

Diagram showing parts of concrete mixer to be lubricated.

NOTE: The above information was abstracted from an excellent booklet, TM5-1074, prepared by the Koehring Co., describing the maintenance of the 75 Dandie mixer. Though the directions refer specifically to this mixer they are generally applicable to all makes.

Reproduction Cost in Fixing Water Rates

In an investigation of the rates and services of the New Haven Water Company, the Connecticut Public Service Commission found, after hearings, that the rates charged by the company are not more than are just, reasonable and adequate, and they were approved accordingly.

The company limited its claims during the hearings to the reasonableness of the rates made effective November 1, 1939, without any intention of asking for higher rates than these in this proceeding. Extensive hearings were held over a period of two years.

Referring to the much discussed subject of the relation of reproduction cost to fair value in rate fixing cases, the Commission said that when the United States Supreme Court in 1898, in the historic case of Smyth v. Ames, 169 U. S. 466, mentioned cost of reproduction as an element to be considered in determining fair value, it did so at a time when the capital structures of railroads and utilities were saturated with watered stock and when there was no reliable record of the money that had actually been dedicated to the public use.

These conditions, the Commission pointed out, did not obtain in the present case. It stated as an added reason for rejecting cost of reproduction, the fact that "it not only introduces an element of speculation into the utility picture but it also operates against the public in a period of falling prices because no Commission would dare be consistent to the point of reducing the rate base, upon a reproduction cost estimate in such a period, with resulting danger to the solvency of the utility and hence the capacity to render adequate service."

The Supreme Court's recent decisions, the Commission avers, have freed Commissions from the binding of reproduction cost estimates in the determination of fair value. (See e.g., Los Angeles Gas & E. Corp. v. California R. Comm., 289 U. S. 287; California R. Comm. v. Pacific Gas & E. Co. (1938), 302 U. S. 388; Federal Power Commission v. Natural Gas Pipeline Co. (1942), 315 U. S. 575.)

But in the present case the Commission found it unnecessary to give any conclusion of its own on the subject.

A landscape architect has been retained by the city of West Bend, Wis., to plan the landscaping of the sewage disposal plant area.

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An open letter to the Municipal Executives of Everytown, U.S.A.

On battlefronts throughout the world, our boys are risking their lives to preserve our way of life. When they return, what will they find here at home? A better America? An immediate job? That is what everybody hopes.

Helping to provide that is the desire as well as the responsibility of every mayor, every city manager, every councilman, every operator of municipal services, and every citizen of America.

One way we can provide our boys with immediate jobs...and at the same time benefit our cities, towns, and villages...is to improve and expand our water and sewage systems.

Such a program would be of particular value because it could be started immediately when wartime restrictions are lifted, providing returned soldiers and war workers with jobs during the period that industry will require to reconvert from war to peace production.

But if this program is to be effective, planning must be started now.

Time may be shorter than we think. By starting now, confusion can be avoided. Planning can be constructive, efficient. Local needs can be analyzed. Working plans prepared. Specifications and contract documents drawn up. Enabling legislation enacted. Financing arranged. Rights of way purchased. Everything put in order, ready to go when the boys come home again.

As an aid to municipalities in planning permanent public improvements of benefit to every member of the community, the Committee on Water and Sewage Works Development has prepared a booklet entitled "Blueprint Now." In case you have not received a copy, we are sure they will be glad to send you one. The Committee may be addressed at Suite 2110, 500 Fifth Avenue, New York 18, New York.

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This booklet can help you sta
planning now.

Effect of the War On Municipal Expenditures

Comparison of expenditures and appropriations of 30 cities of all sizes before and after Pearl Harbor on maintenance of streets and sewers, and for refuse collection, show an increase. Per capita rates are higher in small cities than in large ones.

DIFFICULTY of obtaining materials and labor for maintaining streets, sewers, waterworks and other municipal utilities and services has tended to diminish the amount of such work done during the past two years. The expenditures, however, have not decreased in like proportion, since prices and wages have increased, with a tendency to offset the decrease in amount. The average net effect in a number of large and small cities is shown in the accompanying table, and indicates that this net effect has been an increase in expenditures for these purposes.

The data used in obtaining these figures were collected by the American Public Works Ass'n from 111 cities of more than 10,000 population. A number of these did not furnish all the data needed for each of the three years; only 22 of the 56 having populations less than 50,000 furnished the needed data; and only 8 of the 12 largest cities. However, the number would seem to be sufficient to give a general idea of the average trend, if any.

It appears from the table that the large cities made appropriations for 1942 larger than the 1941 expenditures for street maintenance, sewer maintenance and refuse collections; as did also the small cities except for street maintenance. These appropriations presumably were made before Pearl Harbor. In making their 1943 appropriations in 1942, the smaller cities decreased the appropriations for street maintenance, but increased those for sewer maintenance and refuse collection. The large cities, on the contrary, increased the street maintenance appropriations and decreased those for sewer maintenance.

Comparing the 1942 expenditures with the appropriations for that year, we see that the smaller cities exceeded their appropriations for sewer maintenance and refuse collection, but kept 23% below the appropriation for street maintenance; and the large cities kept slightly below the two former and above the latter. An inspection of the data shows that the averages are fairly representative, although the variations were wide. For example, of the 22 small cities, five spent beyond the appropriations for streets and one as much as 60% less. Naturally, exceptional conditions caused some wide departures from the averages. Wartime traffic in some cities increased cost of street maintenance; influx of war workers increased amount of refuse to be collected and length of sewers to be maintained. But more than fifty percent adhered fairly closely to the average.

Reducing the 1941 expenditures to a per capita rate based on the 1940 census, we find the rates for each of the services considerably higher in the small cities than in the large; 73% higher in the case of streets. The latter seems reasonable, for the average mileage of streets per thousand population was 3.06 for the small cities compared to 1.50 for the large.

In the case of the smaller cities, street maintenance cost 3½ times as much per capita as sewer, and refuse collection 4½ times as much. In the case of the larger cities, street maintenance cost 2½ times as much as sewage; refuse collection 4 times as much.

Use of Caustic Soda on Trickling Filters

By D. H. HURST
City Engineer, Tifton, Ga.

THE Tifton, Georgia, sewage plant treats not only the city's domestic sewage but also waste from an Armour Packing Co. plant, which is kept separate from the sanitary sewage. The packing plant waste is applied to a 55 ft. trickling filter, and the effluent from this is combined with the screened sanitary sewage. The combined sewage is then settled and applied to a 115 ft. diameter trickling filter.

The packing house waste contains large amounts of grease, as does also the combined sewage, and this collects on the filter stone and causes ponding. For a time we tried to remedy this condition by loosening up the top of the filter with a pick or crowbar, but this gave only temporary relief, and we experimented on one of the filters with the use of caustic soda. Knowing that caustic soda combines with grease to form soap, which is soluble, we figured that if it were applied to a filter the resulting soap would be washed on through by the sewage.

EXPENDITURES AND APPROPRIATIONS, 1941-1943
For maintenance of streets and sewers and for refuse collection

	1941	*1942*		*1943*
Street Maintenance and Repairs	*Expenditures*	*Appropriations*	*Expenditures*	*Appropriations*
22 cities, 10,000 to 50,000 population	$624,690	$619,160	$476,650	$530,644
Per capita	$1.23			
8 cities, 500,000 to 2,000,000 population	6,876,176	7,957,966	8,166,772	8,765,775
Per capita	$0.71			
Sewer Maintenance and Cleaning				
18 cities, 10,000 to 50,000 population	166,584	186,097	193,747	214,886
Per capita	$0.35			
6 cities, 500,000 to 2,000,000 population	1,955,100	1,979,384	1,555,108	1,627,750
Per capita	$0.29			
Refuse Collection				
18 cities, 10,000 to 50,000 population	604,240	629,259	629,683	688,945
Per capita	$1.56			
7 cities, 500,000 to 2,000,000 population	10,523,871	11,584,467	10,349,235	12,053,595
Per capita	$1.18			

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Our filters are so constructed that they can be flooded. In applying the caustic, we first close the filter outlet, then distribute flake caustic over the surface of the filter, using 150 lb. on the smaller filter and 250 lb. on the larger one. Then sewage is applied by the rotary distributor until the filter is full. The filter is left standing full for several hours while the caustic dissolves and combines with the grease in the top part of the bed. Flake caustic is used instead of liquid because then its action is largely concentrated in the top of the bed, where most of the grease is. The amount of caustic used does not destroy the zoogleal jelly on the stones, and the filter is back in good operating condition in 48 hours.

Where the beds cannot be flooded it would probably be well to use more caustic than we do, since the caustic would be carried through the bed to the outlet as fast as it dissolved.

The distributors on the trickling filters (American Well Works, motor-driven type) have been operating continuously for four years, and the only maintenance required has been greasing at regular intervals, cleaning the collector rings with kerosene and sandpaper every six months, and checking the column for plumb.

Merchants Help Pay for Municipal Parking

Operated as a local government enterprise "for shoppers only," the Kalamazoo, Mich., municipal parking lot is attracting attention of city officials seeking ideas for meeting post-war transportation and parking problems.

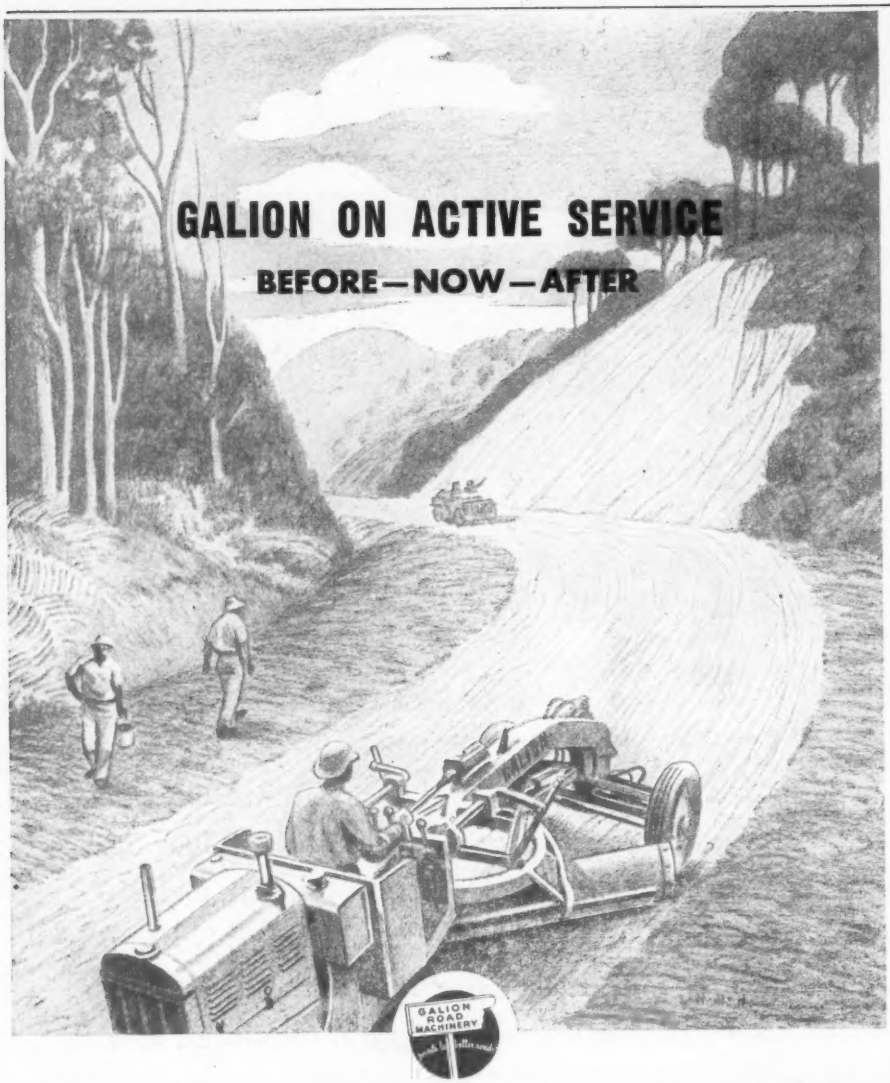
The parking lot, which accommodates up to 400 automobiles, is located in the heart of the Kalamazoo business district. Purchase and construction costs—totaling $60,000—will be paid through special assessments on business properties which were levied with approval of merchants in the district.

The parking lot was constructed in 1939 after a three-year study by city officials and merchants who believed that people were discouraged from shopping in the downtown district because of lack of convenient parking facilities, according to the American Municipal Association.

The study showed that certain areas in the business district had been depreciating in value during the previous 15 years and that the city was faced with the necessity of reducing assessed valuations. There was evidence, also, that business property fronting on main streets was becoming less desirable because shoppers tended to patronize only stores where parking space was available.

So land in the heart of the business district was purchased, buildings removed, the lot surface treated and driveways constructed. The $60,000 construction cost was assessed against properties receiving the greatest benefits on an A-B-C zone basis; "A" and "B" zones each paid 40 per cent, "C" zone paid 20 per cent.

The parking area is well lighted for night use and is equipped with an attendant's office, drinking fountain and comfort station. Expenses, such as light, water and other maintenance, are borne by taxes. Income from small parking fees slightly exceeds the cost of attendants. In this connection, there is no charge for the first two hours' parking, but 10 cents is charged for the third hour and 5 cents for the fourth. The rates are for daytime parking only, the purpose being to prevent all-day parking by people who work in the business district. There is no charge between 6 p.m. and 8 a.m.



Galion road machinery got results for its many users before the war—is getting results with our armed forces and with many new improvements expects to serve advantageously after the war. Our Galion Sales Force is constantly offering suggestions and valuable information to benefit users of Galion machines.

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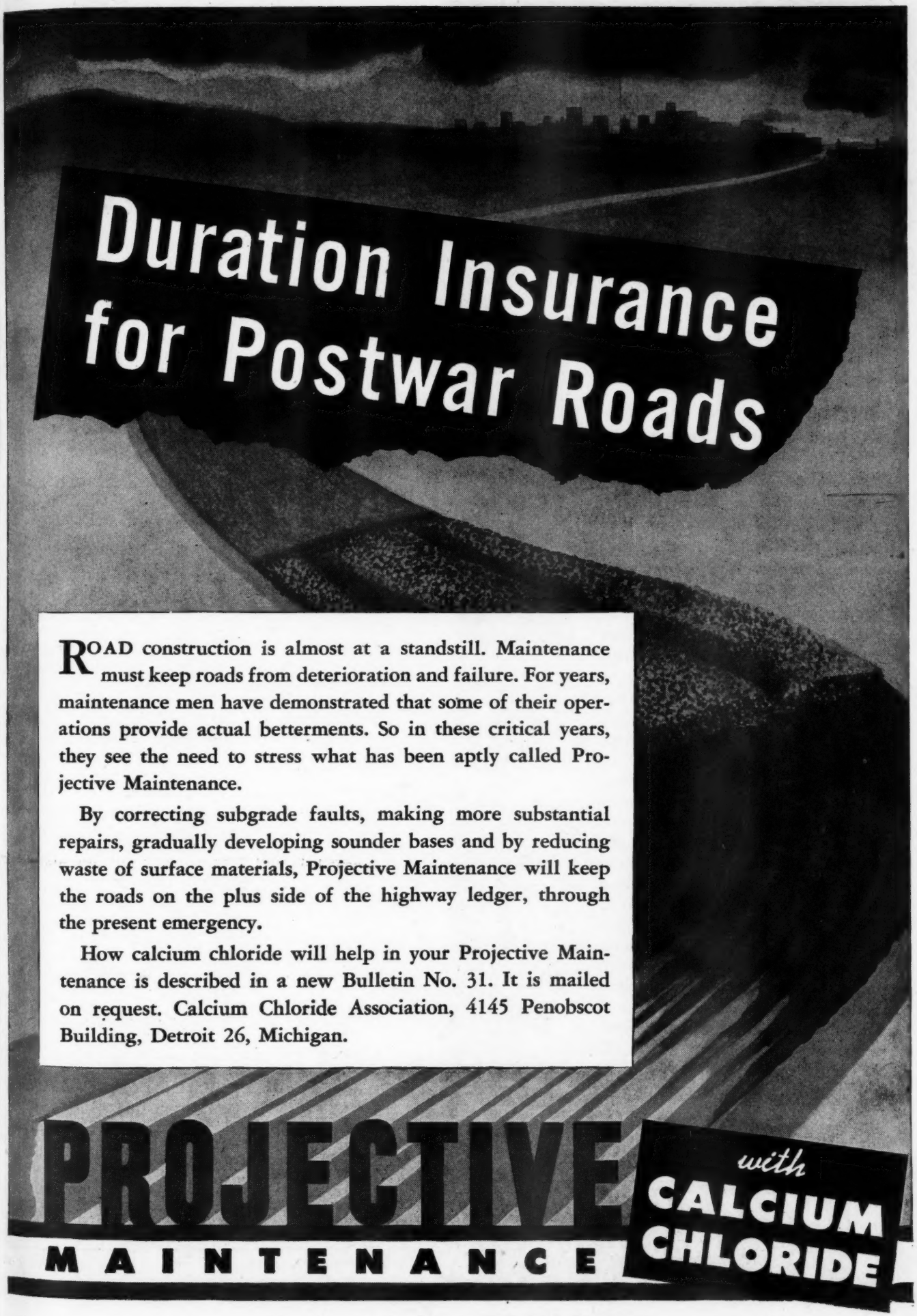
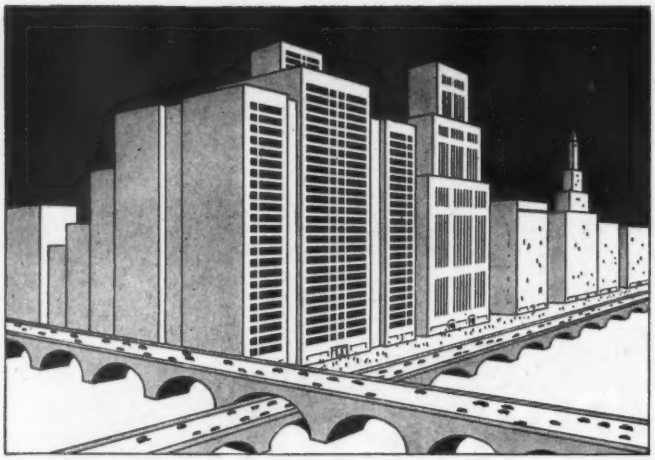
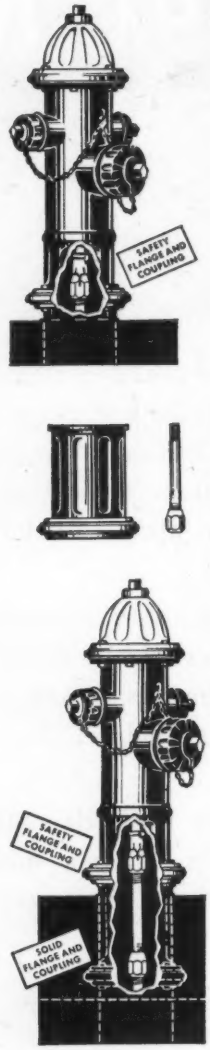

Duration Insurance for Postwar Roads
ROAD construction is almost at a standstill. Maintenance must keep roads from deterioration and failure. For years, maintenance men have demonstrated that some of their operations provide actual betterments. So in these critical years, they see the need to stress what has been aptly called Projective Maintenance.
By correcting subgrade faults, making more substantial repairs, gradually developing sounder bases and by reducing waste of surface materials, Projective Maintenance will keep the roads on the plus side of the highway ledger, through the present emergency.
How calcium chloride will help in your Projective Maintenance is described in a new Bulletin No. 31. It is mailed on request. Calcium Chloride Association, 4145 Penobscot Building, Detroit 26, Michigan.
PROJECTIVE MAINTENANCE
with CALCIUM CHLORIDE



WHAT WILL YOUR CITY BE LIKE IN 1953?

After the war is over and things get back to normal, there will be a lot of improvements made in more cities. Probably new subdivisions, street improvements, grade crossing eliminations, and super highways. These will bring many changes. How about your fire hydrants? Will they be able to keep up with your city's growth? If not, you had better investigate MUELLER-COLUMBIAN Fire Hydrants. . . Here is a hydrant that can stay abreast of the times because of the unique safety-flange section. If nozzle directions need changing, loosen bolts, turn barrel and tighten bolts. That is all. If grade levels are raised, simply add a new extension to barrel and stem. If new industries necessitate steamer nozzles, just insert a new barrel section containing one. The old barrel section can be used in outlying districts where steamer nozzles are not needed. And, mind you, all these improvements can be made without buying complete new barrels or hydrants. . . Get the hydrant that can grow with your city and you will save money. Get MUELLER-COLUMBIAN Fire Hydrants.



MUELLER CO.
CHATTANOOGA, TENN.
FOUNDED 1857

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In connection with the current municipal interest in post-war parking facilities, the association pointed out that two states—Illinois and Wisconsin—adopted legislation this year granting municipalities authority to issue bonds for the construction and maintenance of parking lots. The Illinois law, also, gives cities power to levy taxes for this purpose. — From *Minnesota Municipalities*.

Accidents in Public Works

Taking the construction industry as a whole, there has been, between 1926 and 1942, a drop of 87% in the frequency rate of injuries, and 82% in the severity rate. (Frequency rate is the number of reportable injuries per million hours of exposure. Severity rate is the number of days lost as a result of such injuries, per 1,000 man-hours of exposure.) For this drop, great credit should be accorded to National Safety Council. The above and the following figures are from a pamphlet published by the Council—"Accident Rates in the Construction Industry, 1942."

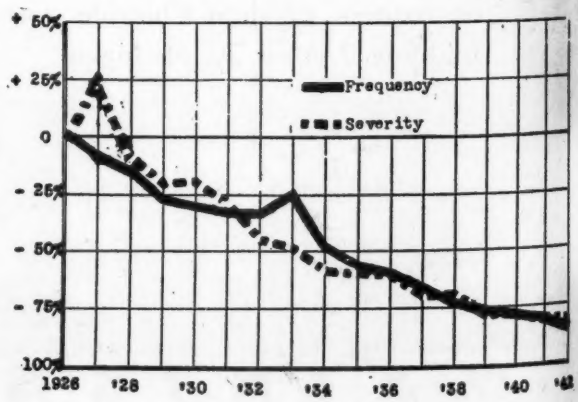
For 1942, for highway work the frequency rate was 21.57 and the severity rate 2.16. For public utility construction the frequency rate was 44.50 and the severity rate 1.31. For earth dam construction the frequency rate was 28.26 and the severity rate 4.76. The highest rates were found on steel erection work—88.74 and 21.00.

The outstanding causes of serious accidents were backing and turning, swinging booms, lowering buckets, etc., without warning or signaling. Unauthorized riding. Inadequate seating facilities on trucks for transporting workers. Working or walking under skips, loads, buckets, etc. Lack of barricades, guard rails, signs and signal men at bridge approaches, intersections and other dangerous locations.

Of all accidents, 44% happened to men who had worked at their job four weeks or less, and less than 2% to those who had been employed six months or more. Classified by the nature of the injury, 20% were to legs, and 13.4% to backs, most of the latter being strains probably due to lifting with the back muscles rather than the legs. This indicates need for training in safe methods of lifting, and for providing sufficient help and mechanical handling equipment.

Mechanical equipment caused 13.7% of the injuries, 5.3% by motor vehicles, 1.8% by tractors and bulldozers, 1.5% by wheelbarrows and hand trucks, 1.3% by cranes, derricks, etc., and 0.9% by draglines, shovels and ditchers.

Accidents on highway work were classified as hap-



Percentage changes in accident rates in construction industry.

before America's first railroad—*and still serving*

Mobile, Ala., 103-year-old cast iron water main still in service.

Lancaster, Pa., 105-year-old cast iron water main still in service.

IN a time of rumor of post-war substitutes for familiar and standard materials, it is well that the pipe buyer remind himself that cast iron pipe is the *only* material for underground mains with a ***known*** record of centuries of service.

The photograph of a cast iron water main, shown on the page opposite, was taken during an inspection twenty years after it had served 88 years in its original location and had been relaid elsewhere. It is today in its 115th year of consecutive service in the water distribution system of Richmond, Va. In Europe, cast iron mains are still in use after more than two centuries of continuous service.

The judgment of a water works or sewerage works engineer who specifies cast iron pipe is vindicated in his own time by untroubled service at little or no maintenance cost—and by future generations for continued tax-saving service, long after bonds issued for the installation have been retired and forgotten.

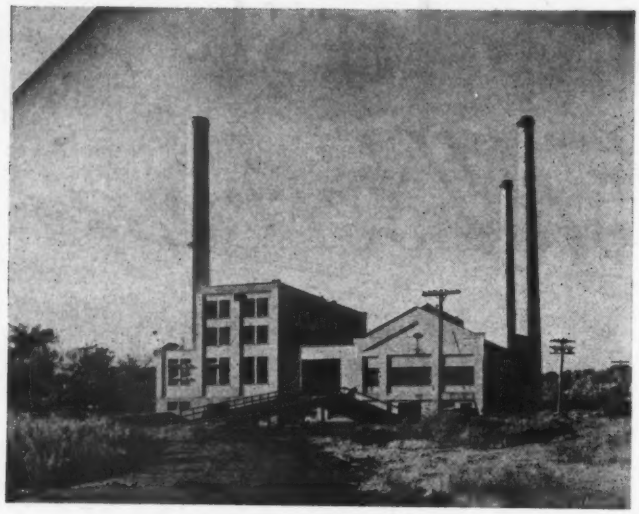
CAST IRON

Cast Iron Pipe Research Association
Thomas F. Wolfe, Engineer, Peoples Gas Building, Chicago 3

Serves for Centuries

When you need special information—consult the classified READER'S SERVICE DEPT., pages 67-69

HEAVY-DUTY INCINERATION
MORSE BOULGER
DESTRUCTORS



Incineration plant at New Rochelle, N. Y., where population increases necessitated two additions to the plant's original capacity. Morse Boulger engineers handled the original plant and the additions.

Why an "Engineered" Incineration Plant?

Because some six branches of engineering enter into the design and construction of an efficient and economical incineration plant. The skilled incineration specialist calls upon his knowledge of chemical, mechanical, electrical, sanitary, civil and traffic engineering because all enter into the problem. Each community's problem is different. "Packaged" incinerators are not for the community wanting the best. Design as well as construction is important.

Morse Boulger engineers can call upon more than fifty years of incineration service to cities and towns. They have built up a reputation of installing well-engineered plants. Assistance in laying out plans is available to those who request it.

MORSE BOULGER DESTRUCTOR CO.
207-P EAST 42d ST. NEW YORK 17, N. Y.
Representatives in Principal Cities

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pening on forces of contractors, state highway department maintenance and construction, and county highways. For 1942 the frequency rate for highway contractors was 44.41 and the severity rate 6.63. For state highway department construction forces the rates were 22.36 and 2.22 respectively, and for maintenance forces 25.19 and 2.18. For county highways the rates were 19.00 for frequency and 2.21 for severity.

Industrial Wastes in California

A recent survey of the industrial waste situation in California indicates an organic load equivalent to the sewage of about 12,000,000 people, which is three or four times the organic load of all urban sewage in the State. Most of this organic waste is of agricultural origin as indicated in the following tabulation:

	Person equivalent
Fruit and vegetable processing	2,500,000
Cane and beet sugar manufacture	1,500,000
Fish canning	1,500,000
Meat packing	900,000
Alcohol and beverage manufacture	2,500,000
Other miscellaneous, about	3,000,000

These figures do not include the non-organic waste such as those from the petroleum industry, iron and steel manufacture, inorganic chemicals and other products.

The Department of Public Health is investigating the matter with a view to so regulating postwar projects as to minimize or decrease the health hazards involved. Population changes, intense industrial activities and consequent heavy factory waste in many of these places where projects are under consideration, make surveys by the department indispensable in order that proper advice in plans, locations, procedure and construction, may be undertaken early.

A Typhoid Epidemic in Northern Indiana

An epidemic of typhoid fever occurred in parts of twenty counties in northern Indiana with a combined population of about 500,000. Two hundred and twenty-five proved cases were reported between January 15 and March 15, 1944. The State Board of Health had as many as 16 or 17 nurses, sanitarians and doctors working to find the cause so that the epidemic could be stopped. Being so widespread, it could not be laid to any public water supply but was probably due to some centrally produced food supply that was eaten uncooked. A Peru dairy company distributed milk throughout the area but no suspicious milk or circumstances connected with its production could be found. Then a case occurred in a hospital in Illinois, where typhoid is so unusual that the case was thoroughly investigated, and it was found that the patient had eaten cheese made by the milk company under suspicion; and the problem was solved.

The cheese had been manufactured in December from unpasteurized milk, some of which probably contained typhoid germs. These germs would have died in a few weeks if the cheese had been allowed to mature, as it usually is; but because of the food shortage this had been sold while quite green. Warning was at once broadcast asking all possessors of cheese manufactured by this company to destroy it. The company has made no cheese since January 1st, and all danger from this source is believed to be past.

IMPORTANT

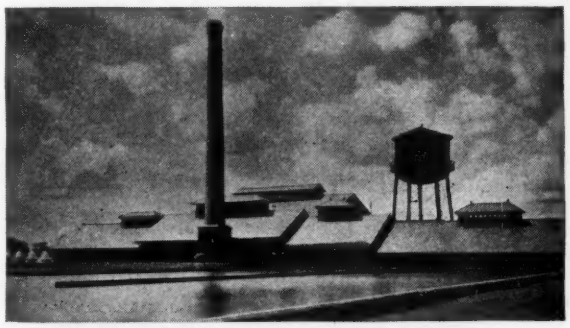
Public Health must be maintained!

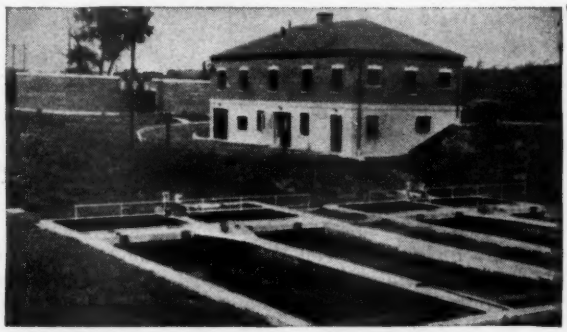
The necessity of maintaining public health in war time is self-evident. Municipal officers in charge of water purification and sewage disposal have a vital responsibility in guarding the nation's health which should not be underestimated as a contributing factor to final victory.

However, the problems of maintaining public health are *becoming increasingly difficult in the face of material shortages and transportation handicaps.* General's "Alum" will help do the job right. But to ease the situation in regard to *Aluminum Sulfate* as much as possible, won't you place your orders as far ahead as you can so that we may schedule our production on an efficient basis.

Why Most American Cities Prefer General Chemical Aluminum Sulfate

General Chemical Aluminum Sulfate is an especially developed "Alum." High quality and constant uniformity have given it a *time-tested* reputation among water works engineers and sewage plant operators, who know its reliability through experience.





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2. Longer filter runs are obtainable.
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5. High in quality, its constant uniformity can be counted upon.

★ FOR SEWAGE PLANTS

1. Clean, easy to handle and economical to use.
2. Simple application, requires only low cost feeding apparatus and minimum attention.
3. Clear, colorless effluents are possible.
4. Precipitated sludge digests readily.
5. Treated digested sludge dries quickly, without odor.

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When you need special information—consult the classified READER'S SERVICE DEPT., pages 67-69

Recent Use of Tar on British Roads

BEFORE the war more than one million tons of tar and asphalt, in approximately equal proportions, were used annually on British roads. War conditions have restricted both the importation of asphalt and the exportation of tar, and the tar industry, various government departments and scientific institutions have cooperated to learn the best procedures for substituting tar for asphalt. Some of the results of these investigations were told by G. H. Fuidge, of the Association of Tar Distillers, in an article in the October 13 issue of "Highways, Bridges and Aerodromes", part of which is abstracted below:

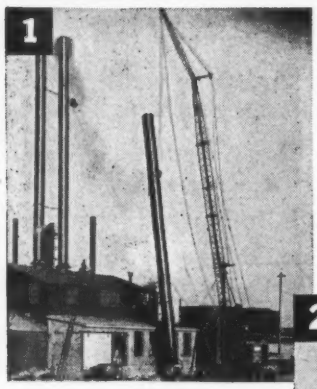
Tar has a higher density than asphalt, the temperature susceptibility, which is the variation in viscosity with temperature, is somewhat greater and the volatility at elevated temperatures is also greater. Tar products generally have somewhat greater wetting and adhesive properties. These differences must be taken into account if satisfactory results are to be obtained, when in any process a change is made from asphalt to tar. Not only must a suitable tar product be selected, but the methods of use previously employed with asphalt must also be modified.

In recent years considerable advances have been made in knowledge of the properties of tars and pitches, which have resulted in improvements both in the quality of tar compounds and in the methods of using them. Therefore, when tar is now used in processes for which asphalt formerly was used, very much better results can be expected than those obtained say 30 years ago.

Thin Carpets. These were introduced some ten years ago as an alternative to tar macadam toppings and as a means of restoring the riding qualities of roads which had lost their contour but were otherwise sound. A great advantage of this type of surfacing is that no surface dressing is required for a period of three to seven years. Tar has been used as the binder for these carpets to a continuously increasing extent. Types B and C are suitable, the latter for the more open type of carpet. With a tar binder the best results are obtained when a somewhat greater proportion of fines is used than that commonly employed with an asphalt binder. The void content is thus lower, although not sufficiently so to cause smoothness.

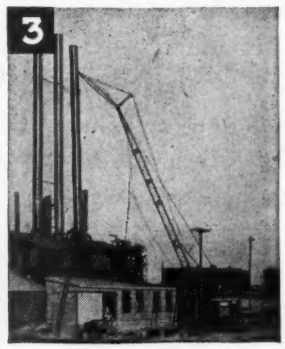
Fine Toppings for Cold Laying. Fine toppings which can, if necessary, be stored before use and which give a sandpaper-like surface, have been used in large quantities for surfacing and patching, and are now being used in aerodrome construction. This type of material requires a road tar of about 30 deg. C. E.V.T., which may be type B, or a special slow-hardening tar, giving the toppings long storage properties. The aggregate is the normal type of ⅛ in. to dust granite, slag or limestone; to obtain the best results this should contain at least 10 per cent. passing 200 mesh. A binder content between 7½ and 8½ percent. is required, depending upon the grading and other characteristics of the aggregate.

In manufacturing the fine toppings an important requirement is that the mixing temperature must not exceed 160 deg. F. In view of the strong wetting properties of tar, it is not necessary that the aggregate should be completely dried.



"Can't Say Enough for General Supercrane"

says Henry Selinsky



READY

Here's how easily and economically Contractor Henry Selinsky handles an 80-foot, 3 ton stack with his GENERAL Supercrane, equipped with 100 foot boom.

IN THE AIR COMPLETE

Resourceful use of his rubber-tired, one engine, one man-operated GENERAL Supercrane is an everyday occurrence with Contractor Henry Selinsky, of Canton, Ohio. For example—

After a hurricane leveled part of a war plant, Selinsky added an extra 50 feet of boom and passed new girders over other buildings (in which war production continued) to complete the new structure in record time.

This 100 foot boom also made quick work of the setting of a new 80 foot, 3 ton stack (as pictured above) and on another war plant job, he handled 13 ton storage tanks fast and accurately, working at an 18-foot radius.

These are typical of how easily and economically the toughest jobs are handled by General Supercranes. Of GENERAL'S dependability and versatility, Selinsky writes: "I can't say enough for the General . . . it's a real crane." For all the aggressive contractors like Henry Selinsky, General has developed the Supercrane one step farther in engineering the "Machine of Tomorrow" which will set new standards of performance in post-war materials handling and construction.

The GENERAL EXCAVATOR CO.
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DIESEL - GAS - ELECTRIC
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THE OSGOOD COMPANY, Marion, Ohio

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Low Void Carpets for Hot Laying. Satisfactory carpets of the rolled asphalt type can be prepared, using a road tar binder of high viscosity, 50-55 degs. C. E.V.T. A material for single and two-coat construction termed "hot process tar macadam," and which contains a graded aggregate from 1¼ in. or ¾ in. down to filler with a binder content of 7 per cent., has given satisfactory service on the Kingston by-pass for thirteen years. Stone-filled sand carpets having aggregate grading similar to those given in B.S. 595 and containing some 12 per cent. of filler and 8 per cent. of this high viscosity binder, have been used on surfaces subjected to unusually heavy traffic, e.g. on tank standings. A mixing temperature of 240-260 degs. F. is suitable and the material can be laid and consolidated satisfactorily at temperatures above 120 degs. F. Precoated chippings can be applied to the surface if desired.

Using Cold and Wet Aggregate in Bituminous Road Construction

Special Methods and Materials Must Be Employed to Obtain Successful Results With Wet Aggregates

As a result of some investigations conducted by the Road Research Laboratory of Great Britain, certain conclusions were reached concerning the use of cold and wet aggregate in bituminous road construction. These were presented last November before the Institution of Civil Engineers by H. J. E. Carter and A. R. Lee, who had made the investigation. The conclusions reached were as follows:

(1) Bituminous road mixtures made with cold wet aggregates can be made successfully, but do not appear likely, except in special circumstances, to supersede normal processes in which the stone is used dry and warm; they should be of particular value where transport of materials and savings in equipment and fuel are serious considerations.

(2) Satisfactory mixes can be obtained with most aggregates by the addition of from 1 to 2 per cent. of hydrated lime or Portland cement to the mix before the binder is added, provided that a binder of suitable viscosity is used. Hydrated lime is necessary even when special wetting agents are incorporated in the binder.

(3) In general the larger sizes of stone, such as are used for tar-macadam base course, are more difficult to coat than the smaller sizes suitable for wearing surfaces.

(4) Certain geological types of stone can be more easily coated than others. Better results have been obtained with various limestones, some igneous rocks, and slag than with a quartzite and a porphyritic type.

(5) For all stones the viscosity of the binder must be varied according to the prevailing temperature. This may be done by either: (*a*) using a binder of the required viscosity; or (*b*) adding a sufficiency of creosote oil to the stone followed by the binder, so that the final viscosity is of the required value. With the more difficult stones it is necessary to use a binder of lower viscosity in order to obtain adequate coating.

(6) When it is necessary to use a binder of a final viscosity lower than 20 seconds at 30 deg. C. it may be advisable to mix in from 1 to 2 per cent. of hydrated lime or other suitably fine filler such as Portland cement, after coating is complete, in order to stiffen up the binder and increase the stability of the mixture.

(7) Generally the grading of the aggregate should, whenever possible, conform to the requirements of existing standard specifications for dry aggregate.

(8) With aggregate containing more than about 10 per cent. of material passing a ⅛-in. mesh sieve it is advisable to screen out the fine material before mixing; the fine material may then be added after the larger stones have been coated. If it is not possible to screen the aggregate a reasonable mix may often be made by using the aggregate as found; it will usually be found, however, that the larger stones will not be well coated by this process, as the fine aggregate absorbs most of the binder.

(9) The binder-content should normally be the same as for mixes made with dry aggregate. With one or two types of stone, however, a slight increase is necessary to obtain adequate coating.

(10) The addition of a suitable wetting agent to asphalt greatly increases the resistance of the binder to subsequent displacement by water. Good results may be obtained with tar binder without the addition of a wetting agent.

(11) Asphalt cut back with creosote coats wet aggregate much better than asphalt cut back with kerosene.

(12) The process of adding a metallic salt solution to the aggregate and a soap to the binder, without using hydrated lime, has not been found successful on a large scale.

(13) A mixer with a vigorous action is essential for wet aggregate mixes. The double-paddle type has been found most suitable. Normal concrete mixers with fixed or tilting drums are not recommended for this type of mix, although with suitable precautions, using longer mixing times and a less viscous binder, they can sometimes be used.

Drainage Wells Are Health Menaces

Several years ago a country club in Central Florida drilled a deep well to supply its swimming pool. The well was drilled to a depth of 500 feet, with 172 feet of casing. In 1936, a drainage well had been drilled in this area to 375 feet and cased to approximately the same depth as the country club well. The former, upon being pumped for capacity, brought up an abundance of leaves and highly colored surface water. Bacterial tests of the content were positive.

A supply well was drilled for a jail in Central Florida to a depth of 300 feet. It was located about one-quarter mile from the nearest city drainage well into which sewage flows. Capacity tests at this depth brought forth only offensive septic sewage.

From *Florida Health Notes,* published by the Florida State Board of Health.

Exclusion of Waste Oil From Sewers

Following a fire in a Baltimore, Md., sewer in 1927 caused by gasoline and oil discharged into it, the city passed an ordinance requiring that waste oil, crank case drainings and greases be stored in steel drums by the users, and contracted with oil companies to remove them when full, the company providing the drums where the amount exceeds 20 gal. weekly. In the 17

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CAUSTIC POTASH •

CHLORINE

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• MODIFIED SODAS

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Alkalies and Chemical Products Manufactured by The Solvay Process Company
40 RECTOR STREET NEW YORK 6, N. Y.

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yrs. since then the contracting companies have collected 4,287,714 gal. for which they have been paid $32,013.75.

The oil is purified by pumping it into a 2600 gal. dehydrating tank, in which are several steam coils containing steam at 90 lb. pressure, where it remains 5 to 8 hr. until all moisture has been evaporated. Then it is transferred to a 1500 gal. tank, where sulfuric acid is added precipitating the sludge. Clay is added to the effluent, which is cooked with steam at about 600° F. for 8 to 10 hr. and the more volatile hydrocarbons driven off, which are used as fuel; and the effluent is filtered through a Shriver plate press and is then ready for sale.

Since this ordinance has been in effect there have been no sewer fires.

The above is condensed from a paper before the New York Sewage Works Association by C. E. Keefer.

Gas Hazards in Sewerage Systems and Treatment Works

(Continued from page 16)

construction; (f) stair wells from pipe gallery opened to atmosphere; (g) control house removed from vicinity of gas lines.

In summation, good design practice with respect to sewage gas is (a) isolation of gas lines; (b) insulation of sources of ignition; (c) investigation of indications of leaks; (d) insurance of quick escape of rapid gas accumulations.

(*For accounts of other accidents of this nature, see* PUBLIC WORKS for March 1944, page 49.)

Manhole Investigations of Bureau of Mines

In 1936 so many fatal accidents occurred in manholes due to the presence of dangerous gases that the United States Bureau of Mines issued a special bulletin (No. 2910, Bureau of Mines), from which the following pertinent data are taken.

The gases and the sources of such gases commonly encountered in manholes are as follows:

Poisonous: Ammonia from refrigerating plants, benzol from storage tanks, and gas oil and carbon monoxide from manufactured fuel gas, products of combustion and exhaust gases from motors. Gasoline from storage tanks, hydrogen sulphide from sewer gas and coal gas, sulphur dioxide from burning insulation.

Suffocating: Carbon dioxide from products of combustion, sewer gas, natural gas.

Explosive: Benzol from storage tanks and gas oil, carbon monoxide as above, ethane from natural gas and manufactured fuel gas, gasoline as above, hydrogen from artificial fuel gases and from electrolysis of water, methane from natural gas, manufactured gas, and soil gas.

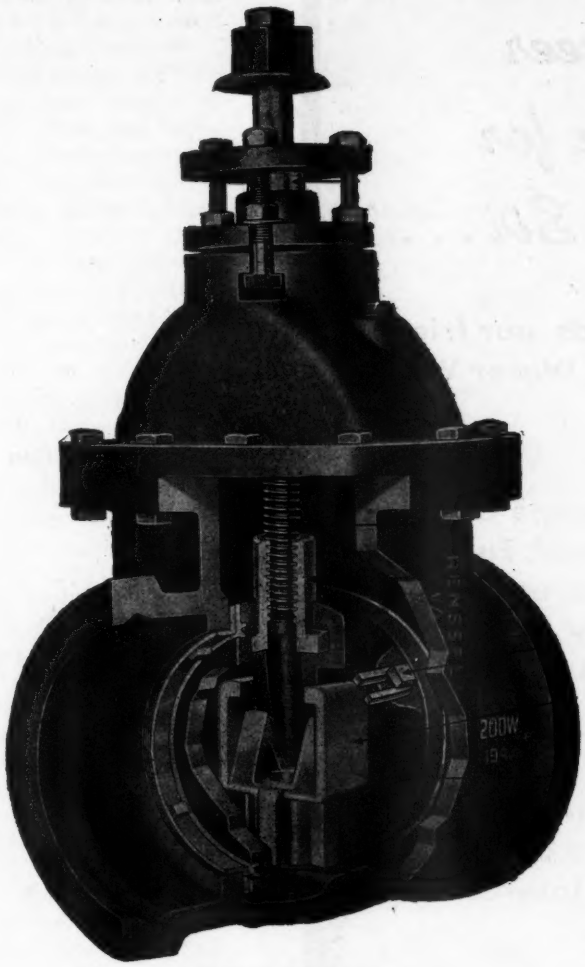
Unsaturated hydrocarbons: From manufactured fuel gases.

After an examination of 28,000 public utility manholes of gas, electric, and telephone companies, the Bureau of Mines recommends in substantial part as the more important safety measures the following:

(a) Before workers are permitted to enter a manhole the air should be tested for carbon monoxide, oxygen deficiency, hydrogen sulphide, and hydrocarbon vapor.

(b) A team of at least two men should constitute a crew for this type of work. No workers should be sent to such a job alone.

(c) Workers should be provided with air-line respirators and proper life lines and these must be used.



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"It's what is inside that counts."

There has never been developed an effective substitute for good material and workmanship backed by sound design

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...—Because Tennessee Corporation's Consultant Staff, Engineers of long and practical experience, have solved many water and sewage coagulation difficulties.

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(d) Manholes should be provided with adequate ventilation by means of a blower during the whole time the men are working therein.

(e) Manholes should be constructed with vent pipes where locations permit.

It appears obvious that the above recommendations apply with equal force to sewer manholes and to underground structures at sewage treatment works.

A discussion of gas hazards, safety measures, and a general review of the entire subject of manhole accidents including practical precautions essential to prevent fatalities also appears in the July 1943 issue of "Industrial Hygiene," a publication of the New York State Department of Labor. Reference is made to gas testers and essential equipment for work where toxic gases or oxygen deficiencies may be present. The recommendations substantially correspond to those in the 1936 Bureau of Mines Bulletin.

Protection from Dangerous Gases

Protection from all gases, vapors, dusts, fumes, smokes, and mists is afforded by hose masks which are the simplest and safest protection for use in very dangerous emergency situations where the wearer need not go more than 150 feet from fresh air (maximum distance approved by Bureau of Mines). It is imperative that such equipment be of a type approved by the United States Bureau of Mines.

Equipment for emergency use as above is further of protective value only if such equipment is inspected periodically and always cleaned, serviced, and carefully inspected after each use. Inspections should be made under the supervision of a responsible person who also has a thorough knowledge of the device and its operation.

"The important requisite of a device to meet the emergency situations is complete respiratory protection with safety provisions against even momentary failure of the device, thereby exposing the wearer to an atmosphere which would immediately jeopardize his life."

The above quotation and the above recommendations are from a special bulletin entitled "Protecting Plant Manpower" published by the United States Department of Labor, to which the reader is referred for additional detailed information.

Experiences in eleven municipalities in New Jersey (1941) are epitomized in a report by Ed P. Decker, who stresses the fact that a good safety device is the cheapest form of insurance.

An article prepared by the engineering department of a company manufacturing sewage treatment works equipment advances many practical suggestions relative to design, particularly from the standpoint of the elimination of gas hazards. Among the suggestions made are the following:—(a) Provide ground level access to control chambers. (b) Provide windows for light and ventilation. (c) Install forced draft fans of sufficient capacity to insure a complete change of air in from two to three minutes. (d) Place in an isolated chamber, accessible only from an external ground level entrance, all gas meters, flame traps, gas compressors, and controllers.

The reader is referred to publications of the United States Public Health Service ("What to Do in Case of Accident") and the American Red Cross ("First Aid Text Book") for details of the health aspects of sewage treatment works accidents, first aid equipment designed to prevent such accidents and for rescue work.

The above cited publication by the United States

We're just little people

We're not brass hats.
We're not big shots.
We're just plain folks . . . but
We're the folks who made this country!
And we're the folks who will save it!

Save it from *two* things it's *got* to be saved from now.
The first thing is the Enemy. The second's
something that doesn't look very dangerous, but is.
It's the danger of Prices Getting Out of Hand.

Here we are this year—after we've paid our taxes—with
131 billion bucks in our pockets.
But only 93 billion dollars' worth of goods to buy.
That leaves 38 *extra* billion dollars.

Sure, the easy thing to do is to take that 38 billion
and start running around buying things we don't need,
bidding against each other . . . forcing prices up and up!

Then people want higher wages. Then prices go up some more
—and again wages go up. So do prices again.

And then where are we!

But us little guys—us workers, us farmers, us businessmen
—are not going to take the easy way out.

We're not going to buy a single, solitary thing that we can
get along without.

We're not going to ask higher wages for our work,
or higher prices for the things we sell.

We'll pay our taxes willingly, without griping . . .
no matter *how much* in taxes our country needs.

We'll pay off all our debts now, and make no new ones.

We'll *never* pay a cent above ceiling prices.
And we'll buy rationed goods only by exchanging stamps.

We'll build up a savings account,
and take out adequate life insurance.

We'll buy War Bonds until it pinches the daylights
out of our pocketbooks.

Heaven knows, these sacrifices are chicken feed,
compared to the ones our sons are making.

Use it up . . . Wear it out.
Make it do . . . Or do without.

A United States War message prepared by the War Advertising Council; approved by the Office of War Information; and contributed by the Magazine Publishers of America

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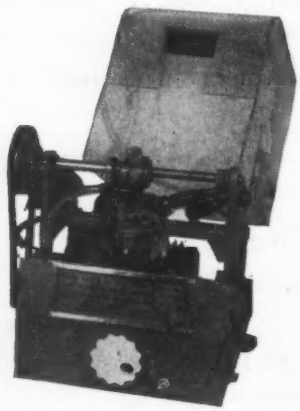

Note substantial 1/10 H. P. gear drive motor and transmission.

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Tuff Condon, President

Public Health Service concludes with timely advice of general applicability to sewer manholes, deep pits, or underground structures at sewage treatment plants, from which the following is quoted:

"Prompt agitation may be more effective than direct rescue since little time is involved. All of these 'pit' conditions suggest stratification of gases for which prompt agitation is the quickest remedy and, fortunately, easily secured as a rule. As in any resuscitation, the point is to get fresh air to the victim the quickest way possible."

First-Aid Material

Certain first-aid material should be considered standard for sewer maintenance crews and at sewage treatment works and pumping stations. This includes a 2-man hose mask with blower for work in low-oxygen atmosphere; explosimeter for explosibility tests; flame safety lamp for oxygen deficiency; oxygen deficiency indicator; hydrogen sulphide detector; and an all-service gas mask for chlorine. The cost of these in December 1943 was $375.

The above is slightly condensed from a bulletin just published by the Ohio Department of Health.

Unusual Subaqueous Pipe Repairs

(Continued from page 18)

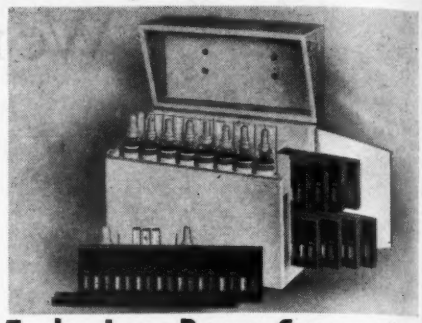
pump with a capacity of 500 gals. per minute at 100 lbs. pressure was also placed on the lighter and connected to the water pipe with fire hose.

The air lift trencher was suspended from the boom of the lighter and lowered to within about 6 inches of the bottom.

The principle of the air-lift trencher is as follows: The water jets cut up the clay much as a man with a pick would do, while the air-lift sucks this clay into its lower end and throws it out of the upper end of the 8-inch pipe. The reason that water flows up the pipe is that air is admitted to its interior through the five small holes at a considerable pressure and breaks up into small bubbles which take the place of solid water. This water full of air bubbles is lighter than the water outside the pipe which, trying to seek an equilibrium, rushes into the bottom of the pipe and so pushes the water full of air bubbles out of the top. As long as the compressor continues operating, the water continues flowing and carrying up mud with it.

Before the trench was excavated, the 500 feet of 8-inch pipe was screwed together just above high water on the Falmouth shore. Over

The Engineer's Friend



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each coupling was placed a sleeve consisting of a 2-foot piece of 10-inch pipe and the space between the sleeve and the pipe was filled with joint compound. This made the joints between the lengths of pipe strong enough to stand rough handling.

Caps were screwed onto both ends of the line to keep the water out and make it more buoyant.

The 500-foot length of pipe was then rolled down on the flats far enough so that at high tide it could be lifted by boats and towed to the trench.

While the tide was low, just before the pipe was to be towed to the trench, 6 ropes were placed under it with buoys on each end, spaced to allow the pipe to be supported from each end of each lighter. An empty steel oil drum was lashed to each end of the pipe and 3 drums between the lighters. These arrangements made the pipe nearly buoyant enough to float.

When the tide was rising and was high enough to allow the lighters to get into position, the ends of the ropes that were under the pipes were attached to the lighters and the pipe raised nearly to the surface. The motor boat then attached a towing line to the first lighter and other tow lines connected the other lighters.

No trouble was experienced in towing the pipe to the trench and, on arrival, one end of each line on each lighter was eased down and the pipe lowered to the bottom.

The approach of darkness made it necessary to leave the pipe on the bottom without knowing how near it was to the trench. It was found the following morning to be about 3 feet from the trench and so it was again picked up and lowered into the trench.

Each end of the new pipe line lapped by the end of the old pipe, and to allow the installation of a split sleeve connecting the ends, the diver marked the new pipe for cutting. The end was then raised to the surface the cap removed, and the pipe burned off at the diver's mark.

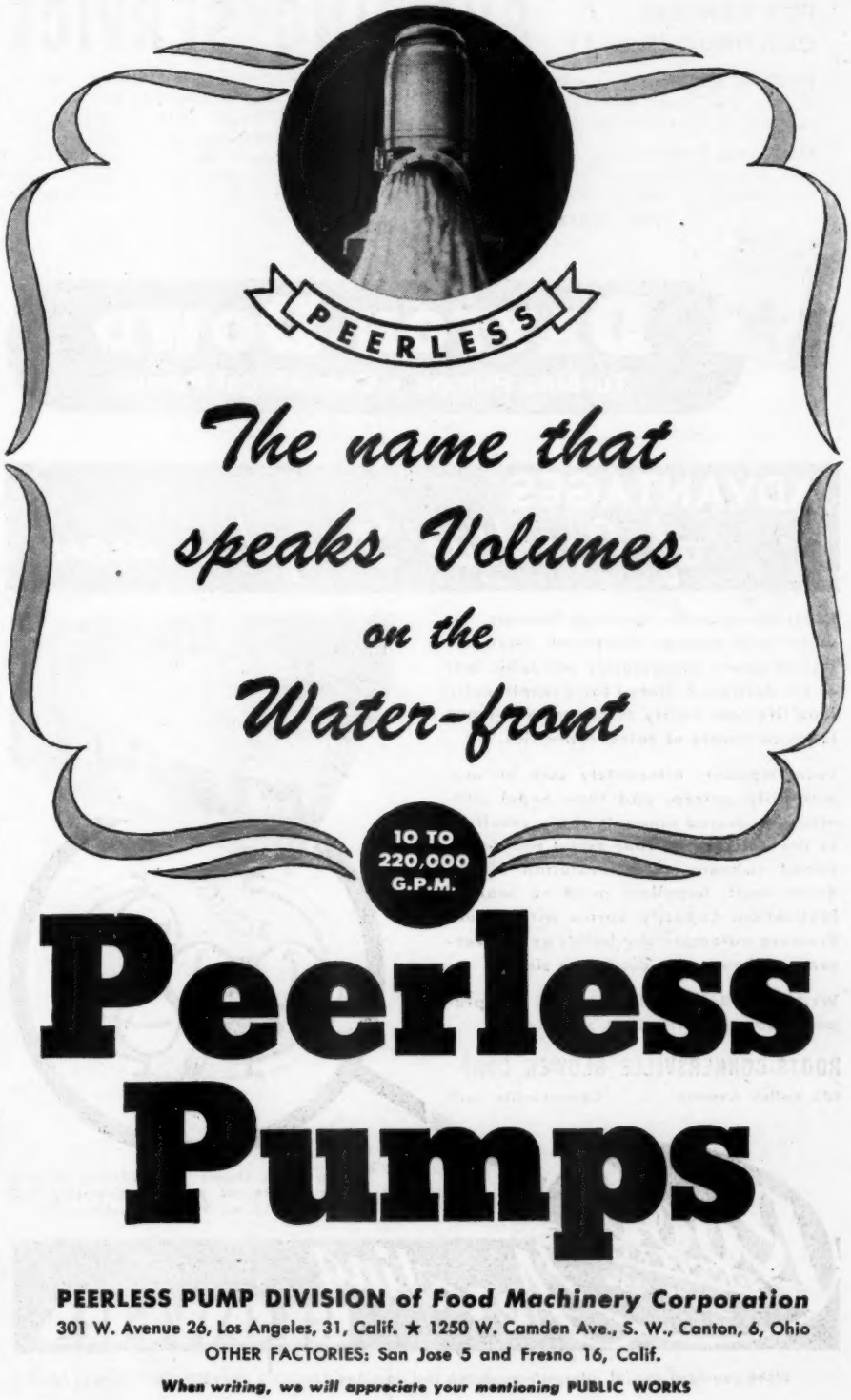
When the pipe was lowered again it was possible for the diver to install the sleeve. He also cut the lashings that held the oil drums to the pipe.

The last part of the work consisted in backfilling the trench and scraping the surplus material down to the required depth. The method adopted was to suspend one or more pieces of railroad iron, 30 feet long, under the lighter at the required depth and, cruising back and forth, shave off the mud, pushing some into the trench over the pipe and the remainder into the deep places left by the dredger.

The above paper is reprinted from the *Journal of the Maine Water Utilities Association*. The description of the air-lift trencher seemed to us especially interesting. No plans of it were drawn, and no photographs of the work were allowed as the work was done in a restricted area.

Changes in Civilian Population

The Bureau of the Census has released figures showing the changes in population, by counties, between April 1, 1940 and Nov. 1, 1943. Of the 3,089 counties, 469 showed an increase of 4,857,885 and 2,620 a decrease of 8,879,105; a decrease for the entire country of 4,021,220, being chiefly the difference between inductions into the armed forces and natural increase. Net increases of 15% or more are found in Washington, Oregon, California, Arizona, Nevada, Utah and scattered counties in other western states, along the Gulf Coast and in Maryland. A decrease of 15% or more occurred in a few counties in almost every state except along the Atlantic Coast from Massachusetts to Virginia, the largest number being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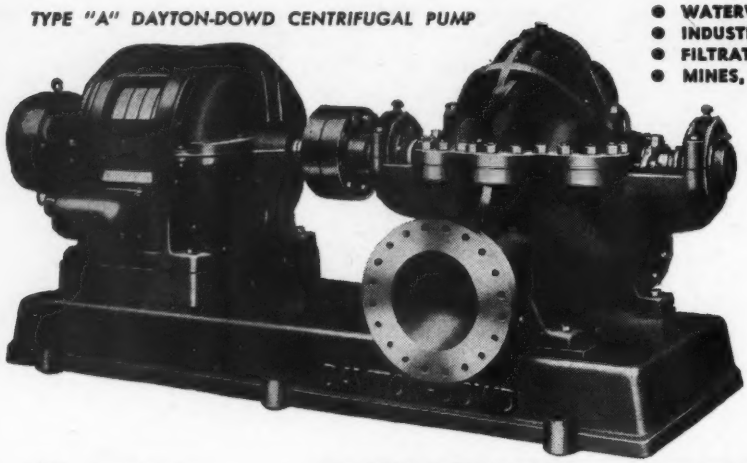

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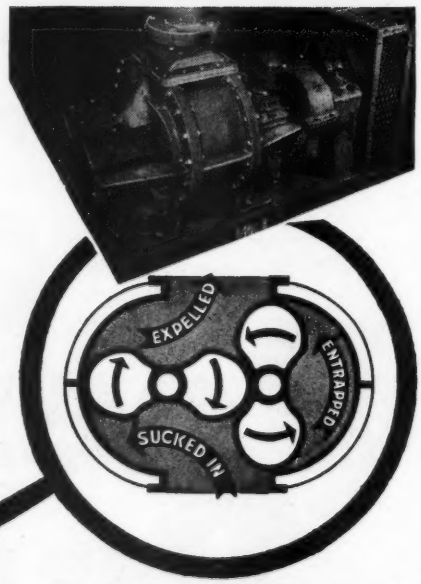

Above photo shows "R-C" Blower used in water treatment process. Capacity 300 c.f.m., 640 r.p.m., 5 lbs. pressure.

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in the states along the Canadian border, Oregon, Wyoming, Colorado, New Mexico, Kentucky, Missouri and Nebraska. In no state were there not some counties showing more than 3% decrease.

Application of Geophysics to Groundwater Problems

(Continued from page 24)

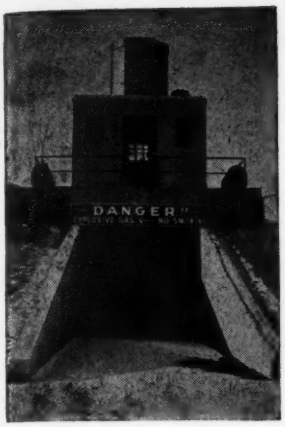
Temperature logs record the temperature of water in the well, and from these logs the temperature of water from the different aquifers may be recognized. An over-all geothermal gradient of a 1° F. increase for each 125 feet obtains in northeastern Illinois below a depth of 300 feet, where the temperature is about 50° F. the year around. In only one or two wells has the temperature approached a constant gradient.

Hole Diameter. A continuous record of hole diameter is furnished by the hole caliper. The caliper tool consists essentially of four arms which are extended by springs, and an electric resistor motivated by the arms. The instrument is run to the bottom of the hole with the arms closed and held to the frame by a small steel band. The arms are opened at the bottom by breaking the band through detonation of a small shot. Then, as the tool is run up the hole, the average hole diameter is logged as a continuous graph by recording the changes in resistance in the circuit due to the arms moving the resistor.

Fluid Resistivity Logs. The logs of the variations in resistivity of the fluid have furnished much corroborative evidence regarding circulation conditions within wells. Logs have been run with several different instruments, all measuring resistivity of the fluid in the well bore with closely spaced electrodes inside an insulated tube. In most of the geophysical surveys made two fluid-resistivity logs have been run, one under natural conditions and the other after salt was added to the well.

Rate and Direction of Fluid Movement. The current meter, modified from the ordinary stream gauging meter, has long been used in water-well work. For use in conjunction with geophysical surveys, on ordinary stream-pipe propeller meter was adapted to run in a vertical plane inside a protecting housing. Three contact pins on the gear driven by the propeller are spaced to create signals from which the direction of flow up or down through the instrument can be recognized. The rate of flow can be calculated from timing the period between signals.

(To be continued)



Entrance to sludge control rooms, Cranston, R. I.

The Sewerage Digest

Abstracts of the main features of all important articles dealing with sewerage and sewage treatment that appeared in the previous month's periodicals.

Overcoming Bulking Reduces Operating Costs

At the Rockville Center, N. Y., plant, built in 1929, bulking in the activated sludge became such a problem, causing clogging of the sand filters, that vacuum filters were installed. After three years of patient and persevering study and trials, the bulking problem has been solved, not by one factor but by "many mechanical procedures along with an understanding of the unit of life, be it aerobic or anaerobic." Because of this, it has been possible to discontinue use of the vacuum filters, saving in one month 41,000 kwh of power, 6 mg. of water, and releasing two operators for other work. The suspended solids in the plant effluent are slightly higher now but meet the requirements of the State Health Dept. and the Interstate Sanitation Com'n.[C42]*

Composting Sewage Sludge

An experiment in composting straw and sewage sludge is being tried at Andover, England. Each compost heap, 9 x 27 ft., contains 4 tons of straw applied alternately with liquid sludge in three 18" layers per day for 6 days; about 800 gal. of liquid sludge per day, or 20 tons to a heap. The sludge was raw sedimentation tank sludge containing 95% water. The heaps are placed on the chalk which underlies the district and are aerated by means of pipes.[D12]

Rainfall Distribution At Louisville, Kentucky

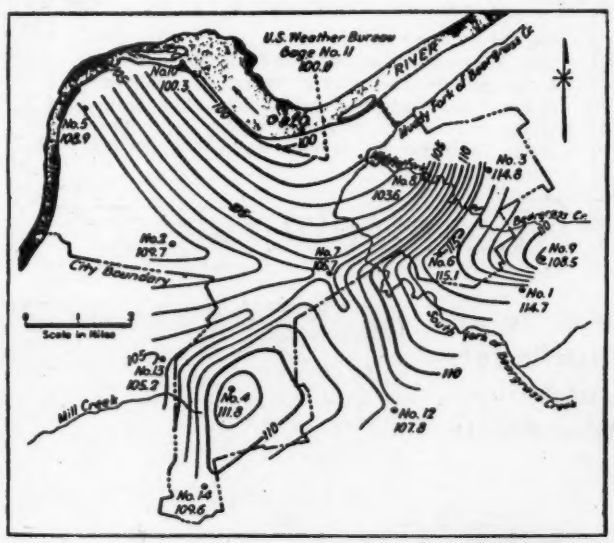
Rainfall data obtained from 1927 to 1941 by a U. S. Weather Bureau automatic recording gauge 183 ft. above street level in the north-central section of Louisville, and by 13 Sewer Commission gauges only a few feet above the ground, illustrate the wide variation that may occur in annual precipitation over a comparatively small area, and in intensities during a given storm at gauges relatively near together. The amount of rainfall during any one year at the various gauges has ranged from 84.4% to 121.9% of that at the Weather Bureau gauge the same year. The records plotted in the illustration show two regions of high rainfall in the hilly portion of the city, and areas of lower rainfall in the flat plain along the Ohio river. The maximum intensity recorded at one gauge never extended as far as an adjacent gauge.[E7]

Sewerage in Latin America

In at least 2 of the 18 Central and South American republics there are no municipally operated sewerage systems. It is a common practice for sewage to flow through open ditches in the most densely populated parts of cities. Use of untreated sewage in crop fertilization and irrigation results in high morbidity from intestinal infection. The Institute of Inter-American Affairs is sponsoring the construction of 5 sewerage systems in Chile, 2 each in Salvador, Honduras and Mexico and 1 each in Colombia, Costa Rica, Ecuador, Paraguay and Peru; with treatment plants also in connection with 7 of them. At present 20 sanitary engineers and 11 sanitarians from these countries are being trained in this country. In designing sanitary projects for Latin American cities, simplicity of construction and operation should be the first consideration. The need for sewage treatment is not generally important compared to that for safe water supplies and satisfactory sewerage.[E6]

Substitutes for Iron Manhole Covers

Los Angeles, Calif., investigated, as substitute materials for manhole covers, Douglas fir timber bolted and glued together; 3-ply Douglas fir and maple glued with waterproof glue and treated with preservatives; 4-ply hard wood glued and fastened with wooden dowels; built-up Celotex layers impregnated with a synthetic plastic; asbestos cement concrete; reinforced concrete; natural stone; and rails and concrete. Reinforced concrete was found to be the most satisfactory, but none was as much so as cast iron. The design used is one developed by the American Concrete Institute.[E5]



Courtesy Engineering News-Record

Comparison of annual rainfall received at U. S. Weather Bureau gauge in downtown Louisville with that received at gauges scattered about general area and operated by the Commissioners of Sewerage. Figures below each station number indicate total precipitation at that point compared to Weather Bureau station total, which represents one hundred per cent. The lines connect points of equal percentage.

*See Bibliography in April issue.

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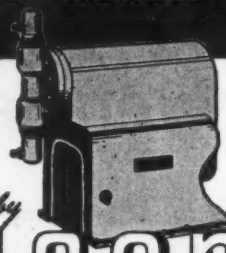

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Central Control at Milwaukee Plant

At Milwaukee, Wis., two activated sludge units, containing 36 mixed-liquor meters, are controlled to give the proper proportion of return sludge to each unit. Before central control was installed, this involved reading all the meters and doing some calculating, and then adjusting a regulating valve, which required walking nearly a half mile; and the valve could not be adjusted oftener than once in 2 hrs., during which period the rate of flow to either unit might change over 60%. About a year ago there were introduced motorization of the sludge valves, with push button control; telemetering of the readings of the Venturi sludge meters to the control room; and summation of the readings of the 24 meters on the mixed-liquor lines in one of the units. When automatic summation of the 12 meters in the other unit has been installed it will, it is thought, be possible to maintain the solids concentration in the mixed-liquor within 1% of that desired.[G10]

Service Charges for Industrial Wastes

Buffalo, N. Y., charges a rental to all persons connected to its sewer system. For domestic consumers this is based on the water meter readings. For industrial establishments whose waste load has a concentration, measured in chlorine demand or suspended solids content, approximately 3 times or more as great as the average sewage received at the plant, charges are based on a formula:

$R = FPc\ (C\text{-}Nc) + FPs\ (S\text{-}Ns)$, where R = cents per 1,000 cu. ft. of waste; F = factor for converting ppm to lb. per 1,000 cu. ft.; Pc = contract price of chlorine in cents per lb.; C = ppm of chlorine demand of the waste; Nc = normal dry weather chlorine demand of raw sewage in ppm of sewage received at the treatment works; Ps = cost in cents for chemicals used in sludge conditioning and for power, for disposing of solids resulting from 1 lb. of suspended solids received in the raw sewage at the plant; S = ppm of suspended solids in the waste; and Ns = normal grit-free suspended solids in ppm of raw sewage as received at the plant. Also it is recommended that provision be made for charging any concern for the cost of cleaning a sewer when clogging is directly attributable to the wastes it has discharged.[G11]

Treating an Ammunition Plant Waste

Waste from a small arms ammunition plant contained 971 ppm total solids, 486 ppm ash, 8.0 copper, 5.2 zinc, 330 ether extract, 231 B.O.D., and pH varying from 1.7 to 9.5 during about hourly periods. Laboratory tests indicated lime precipitation; storing, with mixing, for about one hour for pH equalization; mixing and flocculation for not less than 20 min.; final settling for 1½ to 2 hrs.; and that the limed sludge could be lagooned without creating an odor nuisance, the lagoon to be divided into several areas to permit quiescent settling. A plant giving this treatment produced an effluent having a fairly constant pH, 60% grease removal, suspended solids reduction from 469 to 32.0, and copper reduction from 16.1 to 1.4.[H17]

Preflocculation of Sewage

A study of the phenomenon of preflocculation of sewage indicated that the settleable solids do not act appreciably as adsorbing surfaces for the non-settleable solids, but the phenomenon is mainly one of coalescence of non-settleable particles. The added removal obtained by the return of fresh solids prior to flocculation does not appear to be of practical value.

Presettling reduces the removal by preflocculation only slightly, but the absence of the coarser particles may be detrimental to settling of the fine floc formed by the non-settleable solids on flocculation.

The greatest portion of sewage solids is in the size range between 15 and 40 microns. The particles in this size range are removable by preflocculation. Larger particles

settle out, while smaller ones cannot be removed without the aid of chemicals.

Neither the bicarbonate alkalinity, carbon dioxide acidity, the ratio between them or the pH of domestic sewage could be correlated with the removal obtained by preflocculation of different sewages.[H18]

Hydrogen Sulfide in Aurora's Plant

Hydrogen sulfide in Aurora's sewage corrodes all copper-bearing metals. Also 2" black wrought iron pipe leading gas from the digesters to the meters, in service 12½ yrs., had lost 44% of its weight and begun to puncture slightly, and once or twice a year it is necessary to clean it of a deposit of hard masses of iron-sulfur mixture, which has a tendency to collect at elbows and other obstructions, of which the sulfur content varies from 13.7% to 30.0%. Drip traps were found almost completely stopped with this. The gas dome on the digester corroded through and was repaired. Experiments indicate that the hydrogen sulfide content of the sewage can be reduced 70 to 80% by flotation treatment and plans have been made for installing four flotation units in a spare clarifier as a postwar project.[H19]

Bibliography of Sewerage Literature

The articles in each magazine are numbered continuously throughout the year, beginning with our January issue.

c. Indicates construction article; *n*, note or short article; *p*, paper before a society (complete or abstract); *t*, technical article.

D *The Surveyor*

March 10

10. *p*. The Cyclo-Nitrifying Filter. Discussion of D7. Pp. 113-116.

March 17

11. *p*. Wigan's Sewage Disposal Experiments. By E. T. Crowe. Pp. 129-130.

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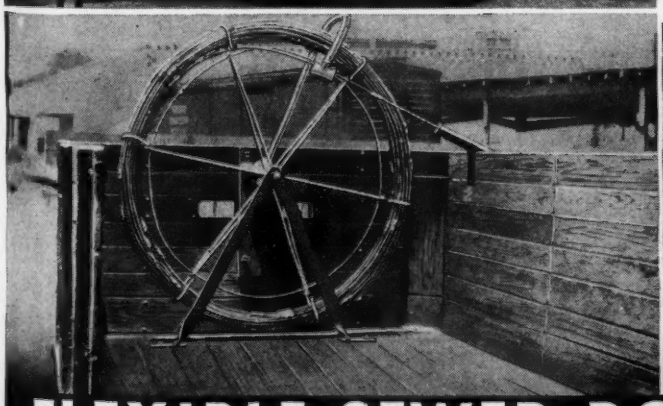

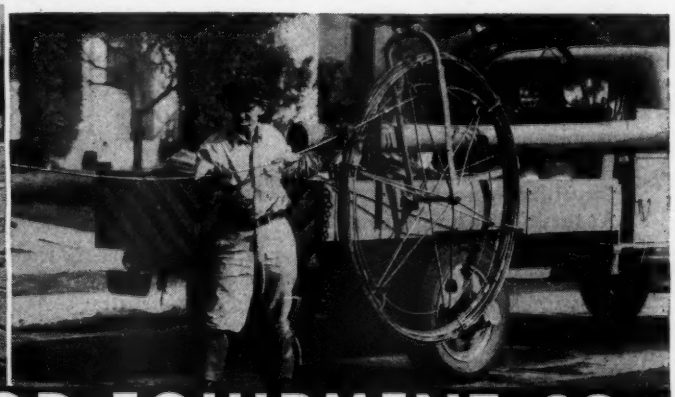

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The Waterworks Digest

Abstracts of the main features of all important articles dealing with waterworks and water purification that appeared in the previous month's periodicals.

Water for Unincorporated Areas

A plan developed by a Virginia company for supplying water to small unincorporated areas consists of a number of units, each serving a few houses near by and all interconnected, a new unit being added as soon as the capacity of the existing ones is reached. A typical unit consists of an 8" well with a deep-well pump delivering water to a 5,000 gal. hydropneumatic storage tank which, with the pump, is enclosed in a fireproof building. This served 7 houses at first, which increased to 20, when a second unit was added ¼ mile from the first, and a concrete reservoir built, the second pumping unit discharging into this when not needed for supplying the distribution; and a booster pump also provided, drawing from this reservoir during peak demands. All operation was made automatic, controlled by pressure in the mains and level in the reservoir. Each user pays $175 for connection to the system and 50 cts. per 1,000 gal. of consumption.[A48]

Tests for Chlorine And Chloramine

The residual chlorine value obtained with methods of analyses in general use may represent active chlorine, less active chloramine, or non-bactericidal oxidizing agents—nitrites, oxidized manganese or oxidized iron. Simple specific tests for active chlorine and chloramine are needed to safeguard the sanitary quality of public water supplies. The unique characteristics of sodium arsenite as a reducing agent when used with ortho-tolidine make it possible to measure separately chloramine and active chlorine. The author describes "A simple ortho-tolidine-arsenite (OTA) field test for residual chlorine and one for chloramine, applicable to concentrations that are likely to be encountered in the treatment of water. . . . Application of the tests to plant control appears feasible with various types of waters chlorinated in the conventional manner. Control of superchlorination would be simplified, since treatment could be defined in terms of a minimum OTA residual for a particular water.[A49]

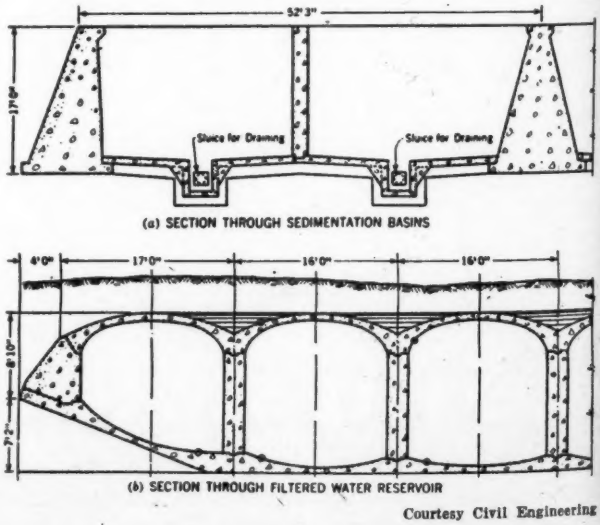
Stabilization of Reservoir Foundations

In 1943 Portsmouth, Va., constructed a 6 mgd filter plant and a 2 mg filtered water reservoir, the soil below which was soft clay and black muck. The structures were of concrete, unreinforced to save steel; which construction added to the necessity of stabilizing the subsoil. Four plans were considered: 1—Replace the soft material, 6 to 8 ft. deep in places, with compacted sand or gravel. 2—Replace it with Class B concrete under the walls and selected fill under the floors. 3—Replace it with Class B concrete under the pipe gallery and with selected fill confined by concrete cells under the walls. 4—Replace it with soil-cement. No. 1 was rejected because of doubt of its effectiveness. No. 2 was the most expensive, No. 3 used too much reinforcing steel, and No. 4 was adopted. The material used was 10 parts of sandy soil containing 15% plus of clay, to one part of cement. The 28-day compressive strength of test cylinders varied from 245 to 500 lb. per sq. in.—ten times the design soil loading. Contract prices were 87 cts. per cu. yd. for excavation and $7.30 per cu. yd. for the 2,843 cu. yd. of the soil-cement in place.[LS]

Needs for Water Supplies

Only 44% of communities of less than 1,000 population have public water systems. About 11% of the population served by public supplies receive water wholly untreated. The number of incorporated communities served by public supplies totals 10,775, of which 4,438 are in communities of less than 1,000 population, 4,304 in those of 1,000-4,999, and 2,033 in those of 5,000 and over. In only four states, Maine, Massachusetts, New Hampshire and Rhode Island, are all communities so served. Less than half the communities have public supplies in Arkansas, Georgia, Indiana, Missouri, North Dakota and South Carolina. It is thought that new water works should be provided in 4,766 communities with a total population of 1,762,404, at an estimated cost of $180,960,000; and that extensions or improvements should be made to 6,455 systems at an estimated cost of $502,340,000. Costs per capita of 781 complete water works systems built during the period 1933-39 average $84 for populations under 500, $65 for those of 500 to 1,000, and $45 for those of 1,000 to 10,000. Present costs are about 32% higher than these.

Softening should be provided in systems serving 20 million people at an estimated cost of $120,000,000. This brings the total cost of water works improvements needed to $803,300,000. Considered by states, more than $25,-

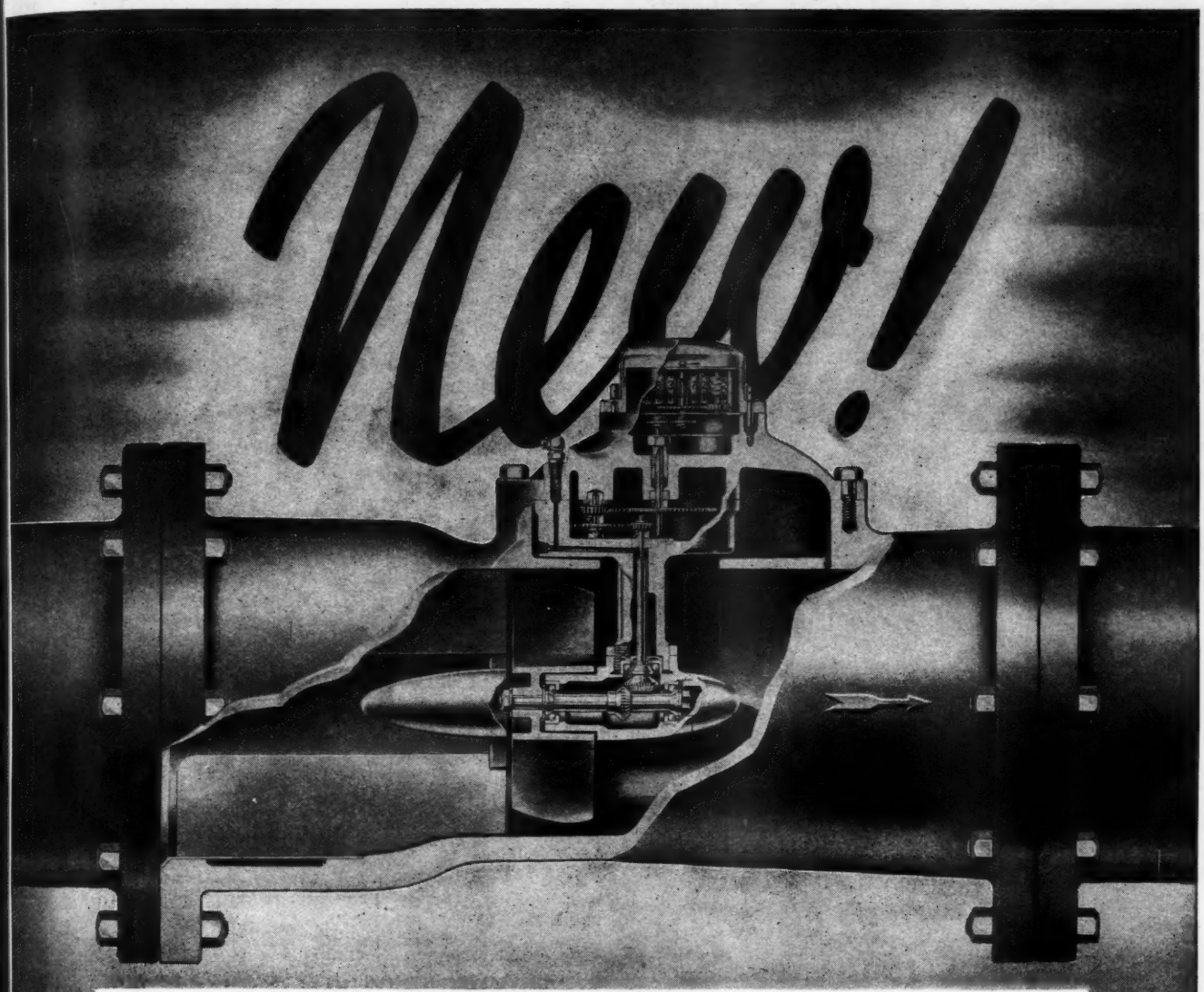


(a) SECTION THROUGH SEDIMENTATION BASINS

(b) SECTION THROUGH FILTERED WATER RESERVOIR

Courtesy Civil Engineering

Sections through additions to Portsmouth Water Works.



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000,000 should be spent in California, Illinois, Maryland, Michigan, Missouri, New York, Ohio, and Pennsylvania; less than $5,000,000 in Arizona, Connecticut, Delaware, Idaho, Maine, Montana, Nevada, New Hampshire, South Carolina, South Dakota, Vermont, Virginia, West Virginia and Wyoming. Only 7 of the remaining states need more than $10,000,000 each.[A45]

Extensions to New Territory

The Railroad Commission of California has been investigating the matter of water service rules and regulations, among the most important being those relating to extensions to serve new territory. It has considered as basic principles that a main extension up to 150 ft. per service connection be made at the expense of the community, except in subdivisions; that the actual cost of the main (not to exceed 4") be advanced after deducting the free footage, this deposit to be refunded at the rate of the cost of 150 ft. of main for each service connection that is made.[A51]

Grounding of Electric Circuits

The A.W.W.A. convention of 1920 adopted a resolution which "approves the practice of grounding the secondaries of lighting transformers to the water pipes, providing that the grounding is done in accordance with the rules of the National Electrical Code and National Safety Code." In 1927 the Association withdrew "its former general endorsement of grounding on water pipes," although approving of such grounding under certain specified conditions. In 1935 it "revoked and rescinded any and all previous approval or sanction of the practice of grounding electric light and power circuits on water pipes for protective or other purposes" because of apparent objectionable results from such practice. The electrical organizations disputed the existence of such results and in 1936 the A.W.W.A. and the Edison Electric Institute agreed upon the formation of the "American Research Committee on Grounding" to thoroughly investigate the question, which committee contained representatives of 16 other national organizations.

This committee has just made an interim report, based upon investigation of reported cases of objectionable results from grounding and upon laboratory investigations. No investigation was made of direct current connections, as these were known to be dangerous. The report states that "No conclusive evidence has been found to date that alternating current of the magnitude measured by the Committee has any appreciable detrimental effect on the pipes or on the water in the pipes. The galvanic couples which exist in most piping systems, between dissimilar metals, or between dissimilar surface conditions on the same piece of metal, may produce currents in the water which are much greater than those produced in the water by current flowing along the pipes." This report is published in the Journal of the A.W.W.A., but the Directors of that Association express certain dissent from it. Such grounding, although common in this country, is not necessary, they say; grounding through automatic safety switching has been widely used in England, Europe and Australia. "It maintains its general objections to the systematic interchange of stray electric current from electrical distribution systems to water pipes, and its unqualified opposition to the use of the water pipe system or its connections as an essential or integral current-carrying part of any electrical distribution system. It is, however, not objecting to the current interchanges which occur during comparatively brief and infrequent intervals when ground connections are fulfilling their specific protective purposes." They find that the electric and other interested parties do not systematically inspect these connections to insure their continued efficiency as they should; and state that "Water purveyors reserve the right to use non-metallic piping or pipe jointing materials for mains, for service piping, or for house piping."[A57]

Consumer Co-operation In Reducing Consumption

The Washington Suburban Sanitary District served a prewar population of 145,000 people in suburbs where large lawns are common and sprinkling produces daily rates twice, and hourly rates nearly 4 times, the average. The supply bottle-neck was the filter plant with a nominal capacity of 10 mgd, and restriction of materials made enlargement of this impossible. Between 1940 and June 1943 the population increased 28.5% and the average water consumption in 1943 was 10.4 mgd. As hot, dry weather came last summer the situation seemed critical. Instead of trying to enforce rigid restrictions, the commission in May informed the citizens of the condition through the local newspapers and asked them to refrain from sprinkling. There was a gradual but noticeable response. Previous high peaks were not reached and burned lawns and drying shrubbery testified to the general compliance. Instead of the 18 to 20 mgd peak expected normally, the average peak was around 12 mgd. Near the latter part of August permission was given to water shrubbery and trees, but not lawns. Meantime the filter plant operated satisfactorly at the rate of 12 to 13 mgd.[A59]

Waste in Industrial Plants

With the enormous increase in war industries there has been a corresponding increase in use of industrial process water and in the importance of limiting the quantity so used. The "once-through" type of cooling system is wasteful, and water can be saved by using a recirculating system. Recirculating water should be kept in proper chemical balance and free from biological growths. Process waters can frequently be used for cooling; also can be re-used, although often only after treatment. In the paper industry the amount of process water used has been reduced from 100,000 gal. per ton of paper to 20,000 gal. Leakages and waste of large amounts of water exist in many industrial plants and should be located and stopped.[A60]

Reservoir Detritus Pollutes Ground Water

Pasadena, Calif., obtains its water supply from four wells and four tunnels totaling about a mile in length, most of the water entering which is percolation from a flood-control reservoir. This reservoir in 1920 had a capacity of 4,554 acre-feet, but floods washed in debris from the watershed until it was 40 ft. deep and reduced the capacity to 2,967 acre-feet. The debris contains much organic matter, and the decomposition of this adds large amounts of CO_2 to the water, and this in turn increases the alkalinity and total hardness; analyses in April, 1940, showing no CO_2 at the surface of the reservoir, 13 ppm at the bottom and 140 ppm in one of the tunnels. There is also an increase in iron oxide content and organisms such as Crenothrix infest the tunnels. Treatment with copper sulfate does not produce satisfactory results, tastes and odors are pronounced, the water is definitely bad, and some solution will have to be found.[A52]

Financing Sewerage From Waterworks Revenue

Akron, O., has a water supply that represents a total investment of $18,128,000. Its income is increasing and debt service decreasing. The city also has a sewage treatment plant built in 1928 to treat a dry solids load of 25 tons daily, to which wartime population and manufacturing is delivering over 85 tons. WPA and PWA aid permitted building two digester tanks and sludge is lagooned; but there is insufficient funds for any further extensions and the city has reached its bond limit. In 1943 the State Legislature passed a law providing for financing sewerage from water revenue, but only when water works and sewerage are conducted as a single unit, under one operating management. No funds from water revenues can be used

for other than water works purposes except from a surplus after paying all expenses of operation, repairs, extensions, interest and other debt service, and the addition of 5% of the gross revenue to a reserve fund. Only 10% of the gross revenue can be used from this surplus, and this for sewerage purposes and poor relief only, the latter not to exceed 3%. If anything is left of the surplus after deducting this 15%, the balance remains as a part of the waterworks funds.[A53]

Epidemic Due to Cross-connection in a Shipyard

In October 1943 an epidemic of gastro-enteritis affected 2,000 out of 15,000 employees in an Oregon shipyard. It was finally traced to the unsuspected connection of the water supply to a fire manifold on a boat hull tied up at the dock, a fire hose connecting this manifold with a fire hydrant. The fire pumps in the hull, when being tested, drew water from the river, which was highly polluted with sewage, and distributed it through the manifold, which was not then *supposed* to be connected with the yard supply but presumably *was*. As the pressure in the supply mains varied from 40 to 75 psi, while that from the fire pumps ran from 80 to 125 psi, river water was pumped into the mains. Of 28 samples drawn from the distribution system, 3 gave positive tests for coliform organisms.[A61]

Army Post Plant Operation

In the 7th Service Command there are 82 posts having individual water supplies, 42 from wells, 36 from adjacent municipalities, 2 from springs and 2 from surface supplies. Most of the wells are in alluvial gravels and are always chlorinated. One well screen became so clogged with *Gallionella* (an iron bacterium) that the drawdown increased from 18 in. to 19.5 ft. After 150 lb. of chlorine had stood in the well for a week, the drawdown was reduced about 10 ft.

Some of the deep-well pumps have caused trouble because it was necessary to order them before their wells had been drilled, on the bases of head conditions and yield which had to be estimated or guessed in advance, and the guesses were not always correct. If actual conditions resulted in overloaded motors, the pump was pulled and one or more of the pump impellers removed—a procedure preferable to throttling the pump.

One supply from a city at a higher elevation had a pressure of 120 lb., which was reduced to 60 lb. by means of a direct-acting pressure regulator. There was no elevated storage or surge protection, and rapid opening and closing of the regulator caused water hammer which blew off all the air reliefs and later a joint failed.

In only three cases is all the supply softened; but unit softeners are provided for boiler plants and laundries where the savings thereby are obvious, at hospital surgeries, and at mess halls where the hardness exceeds 400 ppm, which would produce on the dishes an insoluble film which would interfere with proper sterilization. At one Colorado post the hardness varied from 670 to 900 ppm with a calcium content up to 300 ppm; hot water heaters were completely plugged in 3 to 6 months. This was practically remedied by applying 9.6 ppm soda ash, 10 ppm ammonium sulfate, and 0.5 ppm sodium hexametaphosphate. At a post in the Black Hills water reaches the surface with a tempearture of 138° F. and is passed through cooling coils; in which it at first deposited a thick scale but is now treated with a polyphosphate carrying a residual of about 2.6 ppm and a pH of 8.3.[A64]

Index for Calcium Carbonate Scale

An investigation was made to obtain a formula that would give a quantitative index of the amount of calcium

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carbonate scale that would be formed by a water at any temperature up to 200° F., and to predict the corrosiveness of waters that are not scale-forming. The author uses the name "saturation index" for the algebraic difference between the actual pH of a sample of water and the pH at which it is in equilibrium with calcium carbonate; and "stability index" for twice the latter pH minus the former. The stability index will be positive for all waters; if approximately 6.0 at 60° F., the water should give the best results as regards minimum corrosion and/or scale if a stabilizing treatment of polyphosphate is added. With a stability index of 7.5 or higher at 140° F., corrosion is marked. At indexes of 9.0 or higher, corrosion is serious.[A66]

Distribution Depreciation And Use of Service Headers

The author calls the depreciation in water quality after it leaves the treatment plant "distribution depreciation," and states that it increases with the time elapsing after treatment. This time can be reduced by decreasing the sizes of reservoirs, and of mains below the 6" or even 8" minimum set by designers. This would prevent proper fire protection if adopted throughout; but Richmond uses 3" distribution pipes, called "service headers," where they will meet the demands of the houses directly connected to them. These headers have anti-corrosion linings —usually cement lining. They are not used where the flow through a 6" pipe would be rapid or where the pipe is needed for supplying a fire hydrant.[G13]

Using Old Meters to Advantage

In Pratt, Kans., most of the meters have been in service in the same location for 20 yrs. or more, and in 1940 had never been tested. ("Our meter shop is barely large enough to wring out a dish rag in.") Since then they are being tested as rapidly as possible, and then placed in four classes: E, test within 10% on ¼ gal. flow and run on ⅛ gal. A, come within 10% on ¼ gal. and fail to register on ⅛ gal. F, register 14% to 25% slow on the ¼ gal. Y, will register above 1 gpm but not below that. By reassembling parts from several meters, replacing one or two worn parts by better parts from another meter, two A meters can perhaps be made into an E and an F or Y. The Y meters are placed only where the consumption seldom exceeds the minimum charge, largely for psychological effect. E meters are placed where much water is used, especially in small streams.[F22]

Elevated Concrete Tank Design

Several wartime tanks have been constructed after a recently developed design, to minimize use of steel, cost, and time required for construction. The tank has 1 mg. capacity; consists of a circular 12" concrete wall with prestressed reinforcement, 70 ft. diameter and 35 ft. 9 in. height, covered with a flat concrete dome. This rests on three concentric reinforced concrete cylindrical walls 8" thick, the outer one the same diameter as the tank, the inner one 20 ft. 4 in. diameter; all being 73 ft. 2½ in. high and resting on a reinforced concrete foundation 40 in. thick. All the supporting walls were poured continuously, using sliding forms, in 6½ days, and the tank in 3½ days of continuous pouring. The inside of the tank was waterproofed with Inertol concrete primer and Homastic tank lining.[J10]

Sinking Delaware Aqueduct Shafts

The 85-mile Delaware aqueduct of New York's water suppy, now practically completed, was driven through solid rock, in some places more than ¼ mile below the ground surface, and involved the sinking of 32 shafts from 313 to 1551 ft. deep. Hoisting operations in these shafts involved some major innovations in equipment and methods, which are described in this article. The head-frame over each shaft was a a steel tower 35 to 90 ft. high, at the top of which was a large sheave carrying the non-twisting ⅞" or 1" steel cable of the hoist, which was operated by 75 to 250 hp electric motors.[L2]

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The articles in each magazine are numbered continuously throughout the year, beginning with our January issue.

c. Indicates construction article; *n*, note or short article; *p*, paper before a society (complete or abstract); *t*, technical article.

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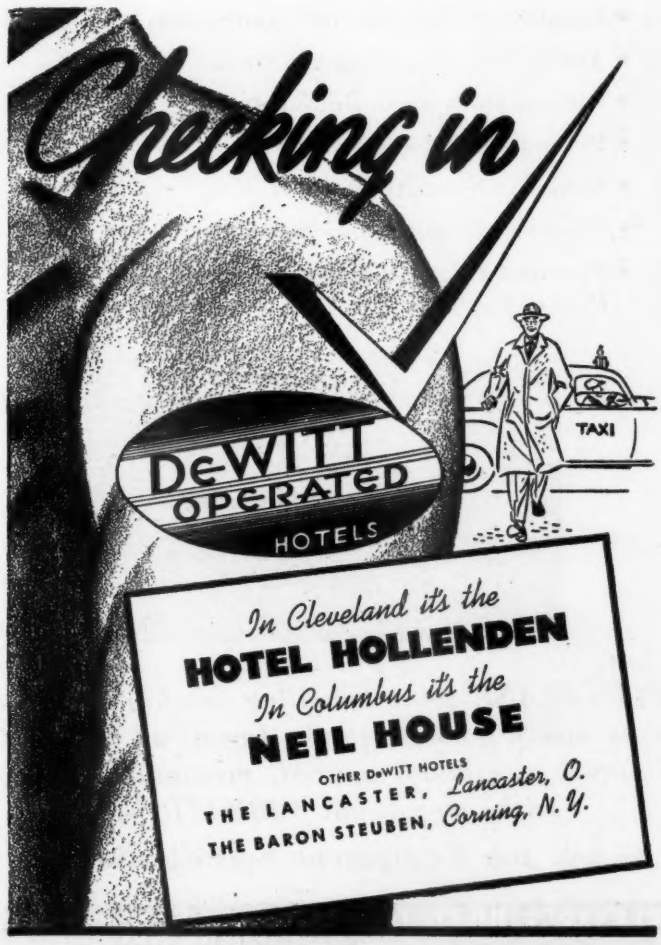

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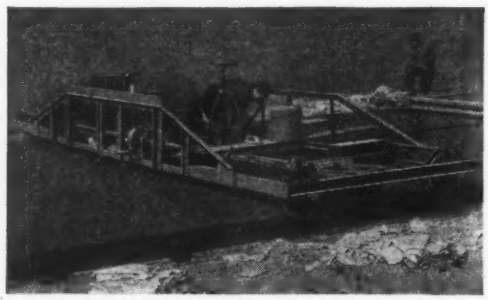
- Reduces the Number of Expansion Joints
- More Dummy Joints Divide Contraction Openings
- Prevents Cracking
- Retards Creeping
- Controls Warping
- Reduces Curling
- Relieves Stress
- Lessens Bumps
- Minimizes Pumping
- Minimizes Panning
- Lessens Deterioration
- Lowest Cost
- Limits Maintenance Cost
- Anchored in Place — Is Permanent
- No Extrusion
- Localizes Expansion and Contraction
- Assists in Normalizing the Slabs
- Ribbon Joint is Continuous in Length
- Prevents Infiltration of Water
- Increases Strength of Slabs
- Produces Homogenous Structure
- Provides Expansion Relief for the Hot Upper Part of the Slab



FLEX-PLANE joint installing machines eliminate messy hand methods. Install all types of joints . . . ribbon, poured, premoulded, etc., with or without VIBRATION.

• Ask for Equipment Specifications •

FLEXIBLE ROAD JOINT MACHINE CO. WARREN, OHIO U. S. A.

When writing, we will appreciate your mentioning PUBLIC WORKS

Keeping Up With New Equipment

Koehring Dandie Mixers to be Manufactured and Sold by Subsidiary Company

The Kwik-Mix Concrete Mixer Company, Port Washington, Wisconsin, a subsidiary of the Koehring Company, Milwaukee, 10, Wis., who has manufactured the well-known Koehring Dandie Mixers for eight years, will now assume the sale, service, engineering and development of the 7-S, 10-S and 14-S Dandie Mixers. Kwik-Mix Dandie Mixers, as they will now be known, will continue to be of the same or better quality with the same important features. Service will be directed from the Kwik-Mix Concrete Mixer Company. Inquiries for information are to be addressed to Kwik-Mix at Port Washington. The Kwik-Mix Concrete Mixer Company also manufactures tilting and non-tilting 3½-S mixers, and bituminous mixers.

The present distributor organization will be increased, as announced by E. A. Kelbe, recently appointed sales manager for Kwik-Mix, to provide adequate coverage for post-war sales.

Syntron Self-Contained Paving Breaker.

Self-Contained Paving Breaker

The Syntron Company,
660 Lexington, Homer City, Pa.

The manufacturer claims this Hammer is comparable in power to the larger-sized compressed air Paving Breakers—weighs 96 pounds—is arranged for easy operation by one man—and uses moil points, narrow chisels, gads, wide chisels, frost wedges, clay spades, backfill tamping tools, asphalt cutters, sheathing drivers or ground rod driving tools, etc., all with 1⅛" x 6" shanks.

Throttle control of the blow permits placing the tool on the spot desired to be worked, without jumping around.

With a solid star drill, and using water to flush the cuttings out of the hole, the Hammer will drill rock to a depth of 30".

The major advantage of this tool is that it is completely, 100% self-contained — and does not require an air compressor, air hose and fittings, ignition battery, ignition coil and heavy cable, or any other source of power or accessory.

In principle, it consists of a 2-cycle gasoline engine in an inverted position—with two pistons, one an engine piston and one a hammer piston.

The engine piston is connected to the crankshaft at the

top of the hammer and drives the flywheel ignition magneto, and a fan for forced air cooling.

Starting is by a rope pull, the same as any outboard engine.

The free hammer piston acts as a movable cylinder head for the engine piston, and as the explosion occurs, is driven downward to strike directly on the shank of the tool being used, and then returned to the "up" or firing position, not by springs, but by low pressure exhaust gases.

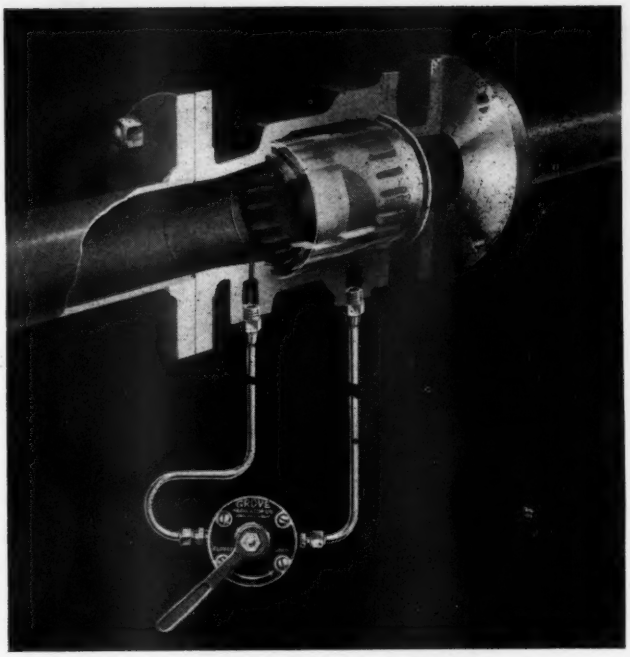
Fuel (gasoline mixed with oil) consumption is relatively low—the hammer being equipped with a fuel tank having a capacity sufficient for several hours operation.

While the bulk of the Company's production must continue to go to the Armed Forces, a few are available for shipment on high Priority rated orders.

Bubble-Tight Remote Control Valve

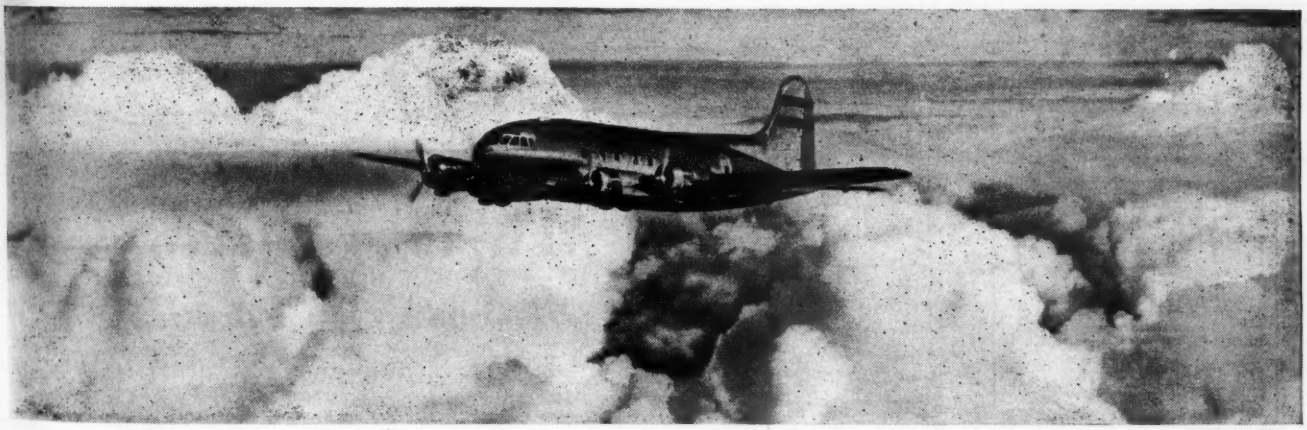
Grove Regulator Co.,
6561 Green St., Oakland 8, California

The manufacturers' description is as follows: The assembly consists of but four parts—1. The valve body, 2. The flange head, 3. A slotted pipe-like core with a solid barrier in the center, and 4. A cylindrical flexible tube. This resilient tube is stretched tightly over the core. Both the tube and core slip into the valve body as a unit and are firmly held in place by the bolted flange head. The flanged ends of the tube serve as a leak-proof gasket sealing off an encircling pressure chamber from the flow stream. Existing fluid pressure in the line forces the tube to fully expand against the inner wall surface of the encasing valve body, thereby opening the valve and permitting a constantly smooth non-turbulent streamline flow. This occurs when the remote control valve is closed. By opening the small remote control valve, line pressure is diverted into the actuating chamber and establishes a pressure balance on the inner and outer walls of the expansible tube. The tube then "flexes" closed over the surface of the core. Static line pressure then maintains a positive bubble-tight, air-tight shut off of the Flexflo valve. There is never the slightest possibility of sticking or freezing.



Cut-away view of Grove Flex Flo Valve.

This valve can be operated hydraulically or pneumatically by various systems such as manual, electro-solonoid, mechanical or automatic remote control. Full details in bulletin form are available on request. Ask for Bulletin No. 800.



T.W.A. Photo

PUZZLE . . . *Where is the Airport?*

The pilot knows—because, far below these clouds, the ever dependable radio range constantly sends out safety signals . . . signals which guide him down through the mist, past jagged mountain peaks, on to the haven of the airport.

Radio Receptor, since the very beginning of the U. S. system has worked with governmental authorities in the development of radio ranges and other radio navigational aids.

In peace, we equipped many leading airports and airways. Today, we are making radio ranges and airdrome traffic controls as our special contribution to the war effort.

When peace comes again, *Radio Receptor*, with its rich background of experience in the design, manufacture and installation of radio navigational aids and airport traffic control equipment, will broaden its activities in keeping with the tremendous growth of postwar aviation.

Send for a copy of our non-technical booklet, "Highways of the Air"—DESK P. W.

A postwar airport development program to cost approximately $800,000,000 is recommended by William A. M. Burden, special aviation assistant to the Secretary of Commerce. The airport survey, made by the CAA in 1939 and which recommended some 4,000 airports, will now be increased to approximately 6,000, most of the increase being in small fields. "One thing is certain," Burden said, "and that is, if the program is to be developed on a sound basis, there must be a far higher proportion of local financial participation than there has been in the past."

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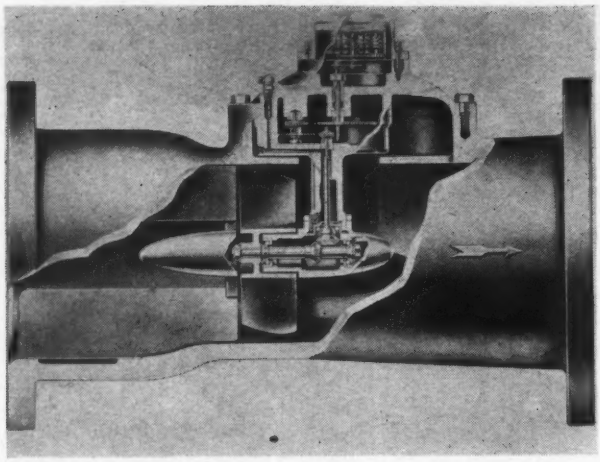
When you need special information—consult the classified READER'S SERVICE DEPT., pages 67-69



Improved Propeller Type Flow Meter

Builders-Providence, Inc.
9 Codding St., Providence, R. I.

Builders-Providence, Inc., division of Builders Iron Foundry, long famous in the flow measurement field, has just announced a new propeller type flow meter for main line metering with many improvements, including streamline Venturi construction. This unit, called a Propeloflo Meter, has an 8-blade bakelite propeller moulded in one piece. Rotation is transmitted through spur and bevel gears. Shafts rotating in ball bearings assure maximum power to drive indicating and recording devices or proportioning chemical feeders. A Venturi throat evenly distributes the force of the flow against the full area of the propeller, resulting in improved accuracy throughout an exceptionally wide range of flow. Spiral flow is eliminated by straightening vanes just upstream of the propeller.

The propeller hub, bracket and nose are streamlined to reduce flow disturbance and divert fine grit, sand or scale away from the mechanism. Engineers will find the unit easy to service, it is said, owing to its "one-shot" lubrication system, the readily accessible stuffing box, and the ease with which the propeller mechanism may be removed from the line for inspection. A blank cover may be installed when the meter is removed. Wherever debris or heavy foreign material may be carried along the line with the moving fluid, Builders recommends and can furnish a section of pipe having a coarse screen and hand hole, to be inserted upstream from the meter. Builders Propeloflo Meter, Model PRF, is a precision-made instrument providing . . . at low price . . . wide range, accuracy and low pressure loss in the measurement of liquid flow in lines 6" and larger. For further information write Builders-Providence, Inc., 9 Codding St., Providence 1, R. I.

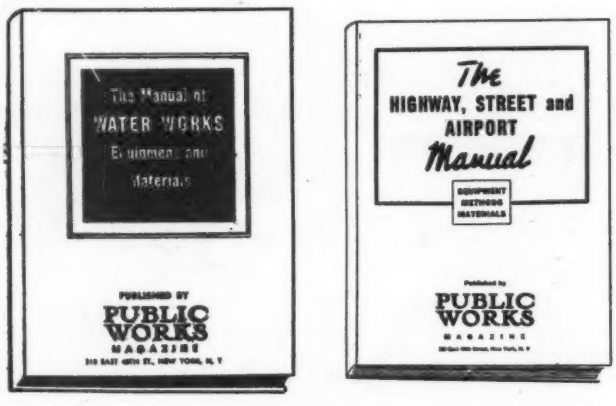
A New Bulletin on the Effective Use of Calcium Chloride from Subsoil to Surface

Highway maintenance can be long lasting rather than only sustaining, is the view expressed in a new bulletin, Projective Maintenance, published by the Calcium Chloride Association.

Because of the war, highway construction has been greatly restricted. Maintenance has not only the tremendous responsibility of sustaining the highway system to support wartime traffic but also of preventing deterioration from reaching such a critical point that reconstruction will be an intolerable burden after peace comes.

More than 50 per cent of all available highway funds will be required for maintenance, according to Thomas H. MacDonald, Commissioner of Public Roads.

"To permit the highways to deteriorate through lack of proper maintenance, would be a blunder the tragic effect of which one cannot estimate," is the statement of



Announcing

NEW 1944 EDITIONS

of these two Manuals

Revised editions of the HIGHWAY MANUAL and the WATER WORKS MANUAL are now going to press and will be ready for distribution within the next thirty days.

The three Manuals published by PUBLIC WORKS are completely revised each year so use of the latest edition means you have before you in one handy volume the latest data on every type of equipment and material you might need.

It is important, therefore, to throw away the old editions when the new ones are received.

Published Annually by PUBLIC WORKS Magazine

F. R. White, Chief Engineer, Iowa State Highway Commission.

The new bulletin points out how calcium chloride can be used from the subsoil to the surface in maintenance operations to obtain lasting benefits.

Post-hole treatment of frost heaving areas is proposed as a corrective treatment for subgrades. Addition of stabilized aggregates is advocated for the strengthening of base courses. Conservation of surface materials through additions of binder soil and calcium chloride treatments is another recommendation. Widening of paved roads, which are too narrow for increased traffic load, calls for stabilized shoulders. The last part of the bulletin deals with expediting patching of concrete pavements by the use of calcium chloride in concrete mixes, for earlier strength and reopening.

The new bulletin is sent to any interested highway official or engineer on request to the Calcium Chloride Association, 4145 Penobscot Bldg., Detroit 26, Michigan.

"Preload" Concrete Tank Construction Saves Steel, Provides Economical Durable Structures

Timely Bulletin on "Preload" Crackless Concrete Tanks and Other Structures

The engineers of The Preload Company claim to have made concrete an obedient servant for large tank construction, making this inexpensive material permanently practical with no maintenance costs for municipal or industrial water tanks, chemical tanks, domes, conduits, canals, sewage disposal plants and other structures where crackless, durable concrete is suited.

With years of research and practical construction, The Preload Company designs, builds, and guarantees concrete tank structures in which are eliminated the destructive effects of load tension, shrinkage, and temperature changes. Factors including earth loads, plastic flow, working stresses and joints, complicated the problem. Now, however, all pioneering uncertainties have been overcome and after constructing a large number of tanks, silos, igloos, domes, etc., all of which have successfully withstood the test of time, The Preload Company has completed several 100,000 barrel oil tanks (4,200,000 gallons) for a prominent company which are said to be the largest successful all concrete tanks ever built above ground.

Engineers and Superintendents of Water Works will find a new illustrated bulletin explaining in detail the merits of the Preload method of prestressing interesting and timely. Write The Preload Company, 420 Lexington Avenue, New York 17, N. Y., for a copy.

Jones & Henry Form New Engineering Firm

Jones & Henry succeeds the engineering firm of H. P. Jones & Co., with offices in the Toledo Trust Bldg., Toledo, Ohio.

T. B. Henry is a graduate in Civil Engineering, University of Pennsylvania, 1919, and has specialized in hydraulic and sanitary engineering. From 1923 to 1927 he was City Engineer for West Palm Beach, Fla., and during that period he was in responsible charge of formulating and organizing plans and supervised approximately $10,000,000 expended in municipal improvements involving city planning, sewerage, bridges, street lighting, hydraulic fills, sea walls, reclamation work, and water supply.

From 1927 to the present time the firm of H. P. Jones & Company has been in responsible charge of investigations, reports, designs, and supervision of construction of sanitary engineering projects.

Harvey P. Jones, University of Michigan, Civil Engineering, 1916. From 1916 to 1918 Mr. Jones was employed by the city of Toledo, Ohio, as Sanitary Engineer, making preliminary studies and designs for sewers and sewage treatment work. From 1918 to 1925 he was with Fuller & McClintock, Consulting Engineers, New York City, in responsible charge of municipal and industrial projects involving collection and treatment of waste products. Later he was manager of the Toledo office and

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directed the planning and execution of numerous projects throughout the Middle West including Kansas City, Buffalo, Memphis, and special investigations relating to new supplies for the city of Toledo, Ohio.

H. P. Jones & Co. was formed in 1925 for handling municipal and industrial engineering problems. The firm served on various boards of review relating to engineering investigations. Mr. Jones is a member of the A.S.C.E., American Water Works Association, Federation of Sewage Works Associations, and other organizations of a similar nature.

Howard W. Cheney Becomes Advertising and Sales Promotion Manager of Macmillan Petroleum Corporation

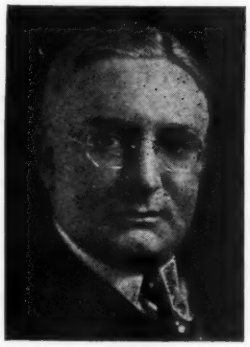
Howard W. Cheney

In preparation for highly competitive postwar marketing of petroleum products, R. S. Macmillan, president of the Macmillan Petroleum Corporation, has announced the appointment of Howard W. Cheney, for the past year advertising and sales promotion manager of the Lockheed Aircraft Corporation to a similar position with his company.

The new petroleum official has an impressive advertising and merchandising background. He served for three years as account executive with Lord and Thomas Advertising Agency, now Foote, Cone and Belding, where he directed the advertising and merchandising activities of firms engaged in national marketing, including oils and aviation companies.

His main activities will be directed toward the sale of Ring-Free Motor Oil, the petroleum corporation's product that has gained national distribution in a phenomenal sales campaign during the past few years.

Following a three months' national tour, during which he will call upon Macmillan's district offices and distributors throughout the nation, Mr. Cheney will make his headquarters at the oil company's main office at 530 West 6th Street, Los Angeles, California.



E. W. Meyers

W. S. Potter

Meter Company Elects New Officials

At the annual meeting of the Pittsburgh Equitable Meter Company, Colonel Willard F. Rockwell was elected Chairman of the Board. Colonel Rockwell, who has been president of the company since 1926, will continue as active head of the firm and serve in the dual capacity of President and Board Chairman.

Subsequently announced were the elections of Edgar W. Meyers as Director and William S. Potter as Vice President.

Mr. Meyers, Treasurer for the past 18 years, will continue to serve in that position.

Mr. Potter formerly was Assistant Works Manager. He has been connected with the Pittsburgh concern for the past 14 years in various engineering and production capacities.

Folder on Sewage Digesters

Ralph B. Carter Co., Hackensack, N. J.

In an 8-page folder the Carter Co. describes and illustrates the mechanism of its Fixed Roof Digester for sewage—namely the sludge scraper, scum breaker, center shafting, gas dome, and drive mechanism. A copy of Bulletin 4311 is available upon request to the manufacturer.

New Engineering and Manufacturing Company Opens Offices in New York

Offices have been established at 420 Lexington Avenue, New York City, by the newly formed General American Process Equipment Division of General American Transportation Corporation, Chicago.

Companies comprising this Division include the Conkey Company, successor to the Conkey Filter Department of Goslin-Birmingham Co., which itself was successor to Industrial Filtration Corporation, and Moore Filter Co., founded by George Moore, a pioneer in the Filtration field.

The Conkey Company was organized by H. M. Hunter, formerly Vice President and Manager of Sales, P. B. Sadler, Chemical Engineer, and G. D. Dickey, Manager of the Filter Department of Goslin-Birmingham Mfg. Co.; also the Louisville Drying Machinery Co., the Turbo-Mixer Corp. and the American Machine Co.

The new organization has at its disposal the most modern and efficient shops for the manufacture of processing machinery and equipment.

A New Bulletin on Self-Priming Centrifugal Pumps

Ralph B. Carter Co., Hackensack, N. J.

In a new Bulletin No. 4310 descriptions and illustrations are given of Self-Priming Centrifugal close-coupled and long-coupled unit type pumps for municipal and private water supply service, for dewatering service, and for pumping gasoline and fuel oil.

If you are interested in self-priming pumps, write the manufacturers for a copy of this Bulletin.

Conventions

May 17—New England Sewage Works Association, Hotel Kimball, Springfield, Mass.

May 19-20—Maryland Water and Sewerage Association, Lord Baltimore Hotel, Baltimore, Md.

May 22-23—Pennsylvania Water Works Operators Association, Community Bldg., Hershey, Pa.

June 13-16—American Water Works Association, Hotel Schroeder, Milwaukee, Wis.

June 21-22—Ohio Conference on Sewage Treatment, Hotel Harding, Marion, Ohio.

Sept. 19-22—New England Water Works Association, Poland Spring House, Poland Spring, Maine.

Sept. 24-27—American Public Works Association, Hotel St. Paul, St. Paul, Minn.

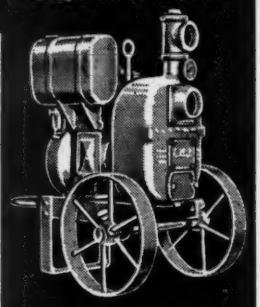
Oct. 3-5—Second Wartime Conference of the American Public Health Association, Hotel Pennsylvania, New York, N. Y.

Oct. 11-14—Federation of Sewage Works Associations, William Penn Hotel, Pittsburgh, Pa.

Oct. 17-19—Southwest Section of American Water Works Association, Stephen M. Austin and Driskill Hotels, Austin, Texas.

Oct. 24-26—California Section, American Water Works Association, Biltmore Hotel, Los Angeles.

C. H. & E. CONSTRUCTION EQUIPMENT



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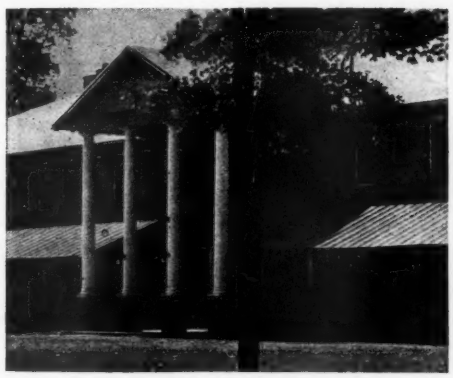

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5. "Highways of the Air" is a new and valuable booklet available for engineers and officials interested in radio traffic control for airports. Illustrated and non-technical. Address: Radio Receptor Co., Inc., 251 West 19th Street, New York 11, N. Y.

Cold Mix Plants

15. New catalogs and prices of Portable Bituminous Mixers in 6 to 14 ft. sizes for resurfacing and maintenance. Issued by The Jaeger Machine Co., 400 Dublin Ave., Columbus 16, Ohio.

Cold or Wet Weather Construction

18. Cleaver Aggregate Heaters and Dryers, Hot Water Boosters, and Automatic Steam plants are designed to speed up cold or wet weather construction. Write for illustrated bulletins. Cleaver-Brooks Co., 3112 W. Center St., Milwaukee 9, Wis.

Concrete Accelerators

31. New 48-page booklet in five sections explains clearly the effects, advantages and methods of using Calcium Chloride and Portland Cement mixes. Complete and packed with practical information; well illustrated; pocket size. Sent free on request by Solvay Sales Corp., 40 Rector St., New York 6, N. Y.

Concrete Curing

33. 64-page manual of concrete curing with calcium chlorides. Complete, handy. Contains useful tables, well illustrated. Write the Columbia Chemical Division, Pittsburgh Plate Glass Co., Grant Bldg., Pittsburgh 19, Pa.

Concrete, Early Strength

38. 64-page manual tells how to speed up year 'round concreting, shows how to secure high early strength and greater workability at temperatures either below or above freezing. Contains many actual examples of practical concreting operations; well illustrated with more than 60 photos, charts, graphs and tables. Calcium Chloride Assn., Penobscot Building, Detroit 26, Mich.

Concrete Mixers

44. Catalog and prices of Concrete Mixers, both Tilting and Non-Tilt types, from 3½S to 56S sizes. The Jaeger Machine Company, 400 Dublin Ave., Columbus 16, Ohio.

Drainage Products

70. Standard corrugated pipe, perforated pipe and MULTI PLATE pipe and arches — for culverts, sewers, subdrains, cattlepasses and other uses are described in a 48-page catalog entitled "ARMCO Drainage Products," issued by the Armco Drainage Products Association, Middletown, Ohio, and its associated member companies. Ask for Catalog No. 12.

Graders, Patrol

105. The Austin-Western 99M Power Grader with its powerful all wheel drive simplifies all construction and maintenance; handles difficult jobs with economy and efficiency; and does better work on grading, ditching, scarifying, snow plowing, loading, mixing, bulldozing, shoulder trenching and backsloping. Write for Bulletin 1946. Austin-Western Road Machinery Co., Aurora, Ill.

Mixing Plants, Asphalt

106. The Cleaver Asphalt Mixing Plant for an inexpensive plant mix and the Cleaver Tank Car Heater and Bituminous Booster are covered in illustrated catalogs sent on request by Cleaver-Brooks Co., 3112 W. Center St., Milwaukee 9, Wis.

Mud-Jack Method

107. How the Mud Jack Method for raising concrete curb, gutter, walls and street solves problems of that kind quickly and economically without the usual cost of time-consuming reconstruction activities — a new bulletin by Koehring Company, 3026 West Concordia Ave., Milwaukee 10, Wis.

Oil, Motor

109. "Here's Proof of Ring-Free Superiority," 32 pages, illustrated, outlines the principles of lubrication and explains how by simple tests you can measure the advantages of Macmillan Ring-Free Motor Oil. Write Macmillan Petroleum Corp., 530 West 6th St., Los Angeles 14, Calif.

Paving Materials, Bituminous

111. New "Tarvia Manual" is packed with useful data on how to build and maintain roads with Tarvia. Each step is illustrated with excellent action pictures, 64 pp. 103 ills. Write to The Barrett Div., 40 Rector St., New York 6, N. Y.

Pumps

120. Interesting new booklet tells how to lengthen the life of your pumps. Explains how a little care will save a lot of wear. Write today for your copy. Homelite Corp., 2403 Riverdale Ave., Port Chester, N. Y.

121. New illustrated catalog and prices of Jaeger Sure Prime Pumps, 2" to 10" sizes, 7000 to 220,000 G.P.H. capacities, also Jetting, Caisson, Road Pumps, recently issued by The Jaeger Machine Company, 400 Dublin Ave., Columbus 16, Ohio.

123. New brochure by Gorman-Rupp Co., Mansfield, Ohio, illustrates and describes many of the pumps in their complete line. Covers heavy duty and standard duty self-priming centrifugals, jetting pumps, well point pumps, triplex road pumps and the lightweight pumps.

124. 16-page illustrated bulletin, SP-37, describes and illustrates complete C. H. & E. line of self-priming centrifugal pumps from ½" to 8", including lightweight models for easy portability. C. H. & E. Mfg. Co., 3841 No. Palmer St., Milwaukee 12, Wis.

125. "Self-Priming Centrifugal Pumps," a 12-page illustrated booklet showing details of construction of Carter Pumps. Ask for Bulletin 4310. Address: Ralph B. Carter Co., Hackensack, N. J.

126. "Humdinger" 2- to 8-inch self-priming portable pumps. A 23-page illustrated booklet giving full details. Address: Ralph B. Carter Co., Hackensack, N. J.

Road Building and Maintenance

127. Two and Four Wheel Scrapers, Bulldozers, Tamping Rollers, Winches, Hoists and Repair Towers are subjects of special bulletins issued by Gar Wood Industries, 7924 Riopelle St., Detroit, Mich.

128. Two powerful Galion motor graders designed to answer every requirement for more speed in road, airport, dam and housing construction work are fully described in a folder illustrated with many action pictures. Issued by Galion Iron Works & Mfg. Co., Galion, Ohio.

129. Warco Hydraulic Control Motor Graders, Duplex Hydraulic Scoops and Whizzard, easily transported, rollers are described and illustrated in literature available from W. A. Riddell Corp., Bucyrus, Ohio.

Rock Drill Maintenance

130. New booklet presents through amusing cartoons useful hints on proper rock drill maintenance methods—what your men can do to get more work out of your tools with a minimum of expense for repairs and compressed air. Write The Cleveland Rock Drill Co., 3734 East 78th St., Cleveland 5, Ohio.

Rollers

133. New Tu-Ton roller of simple construction for use in rolling sidewalks along highways, playgrounds and other types of light rolling is fully described in a bulletin issued by C. H. & E. Mfg. Co., 3841 No. Palmer St., Milwaukee 12, Wis.

138. "The Buffalo-Springfield line of road rollers (tandem, 3-wheel, and 3-axle) are described in the latest catalog issued by the Buffalo-Springfield Roller Co., Springfield, Ohio.

139. "Ironeroller" 3 Axle Roller for extra smooth surfaces on all bituminous work. Booklet contains roller data and operation details. The Hercules Roller Co., Bucyrus, Ohio.

140. This well-illustrated 16-page catalog describes the tandem, autocrat, cadet, and roll-a-plane rollers, and explains what each is intended to accomplish. Write Austin-Western Road Mach. Co., Aurora, Ill.

Rotproofing

145. Cuprinol, a rotproofing chemical that protects wood from fungi and insects, yet has no offensive odor, is non-poisonous, does not corrode metal and can be painted over. Full details in booklet from Cuprinol, Inc., 7 Water St., Boston 9, Mass.

Soil Stabilization

150. "High-Service, Low Cost Roads" is one of the newer booklets using an effective combination of picture and text to set forth the principles and advantages of road surface stabilization with calcium chloride. Complete, interesting and well illustrated 34 pages. Sent by Solvay Sales Corp., 40 Rector St., New York 6, N. Y.

152. The Columbia Chemical Division will be glad to furnish to anyone interested complete information dealing with Calcium Chloride Stabilized Roads. This literature contains many charts, tables and useful information and can be obtained by writing Columbia Chemical Div., Pittsburgh Plate Glass Co., Grant Bldg., Pittsburgh 19, Pa.

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Spreader

187. Jaeger Paving equipment, including Mix-in-Place Roadbuilders, Bituminous Pavers, Concrete Bituminous Finishers, Adjustable Spreaders, Forms, etc.—4 complete catalogs of latest equipment in one cover, issued by The Jaeger Machine Company, 400 Dublin Ave., Columbus 16, Ohio.

Surface Consolidation and Maintenance

188. Detailed and illustrated presentation of the method and procedure in consolidated operations; explains how sub-soils can be conditioned to resist softening and frost action; how surfacing can be consolidated to provide smooth all-weather riding surfaces; how they can be maintained so as to prevent disintegration and gravel loss. Write the Calcium Chloride Association, Penobscot Bldg., Detroit 26, Mich., for Bulletin No. 29.

Transits and Levels

190. Transits, levels, and drafting room supplies: New Catalog just issued. 56 pages giving full illustrated descriptions of surveying instruments and accessories. Address: Warren-Knight, 136 N. 12th St., Philadelphia 7, Pa.

Wellpoints

195. New complete catalog, "Griffin Pointed Wellpoint Facts," just issued. Covers pre-drainage, describing wellpoints jetting pumps, with tables, diagrams and illustrations. Griffin Wellpoint Corp., 881 E. 141st St., New York 54, N. Y.

Street and Paving Maintenance

290. "Blacktop Road Maintenance and Construction Equipment" — Asphalt and tar kettles, flue type kettles, spray attachments with completely submerged pumps, tool heaters, surface heaters, road brooms, portable trail-o-rollers, etc. These are all described in detail and illustrated. This modern and up-to-date equipment for blacktop airport and road construction and maintenance is based upon experience and engineering research over a period of 42 years. Write for Catalog R. Littleford Bros., Inc., 452 East Pearl St., Cincinnati 2, O.

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300. Detailed information and advice about specially engineered Ward LaFrance apparatus will be sent on request. Ward LaFrance Div., Elmira, N. Y.

Snow Fighting

Snow Plows

350. "Frink One-Way Sno-Plows" is a four page catalog illustrating and describing 5 models of One-Way Blade Type Sno-Plows for motor trucks from 1½ up to 8 tons capacity. Interchangeable with V Sno-Plow. Features, specifications and method of attaching. Carl H. Frink, Mfr., Clayton, 1000 Islands, N. Y.

Ice Control

351. "Make Icy Highways Safe for Traffic"—a new bulletin by Michigan Alkali Div., Wyandotte Chemicals Corp., Wyandotte, Mich., tells how to use calcium chloride for modern ice control.

Sanitary Engineering

Aero-Filter

356. Aero-Filter Design Data is given in a new 32-page catalogue. It contains information on Advantages of Aero-Filter Process, Single Stage vs. Multi Stage Treatment, Filter Loadings, Rates of Flow and Results, Filter Depths, Recirculation, Sewage Pumps and Pump Control. Approximately 15 pages of blue prints are included in this instructive catalogue. Write Lakeside Engineering Co., 222 W. Adams St., Chicago 6, for a copy.

Air Release Valves

357. Automatic Air Release Valves for water, sewage and industrial uses are described and illustrated in new catalog issued by Simplex Valve & Meter Co., 6750 Upland St., Philadelphia 42, Pa.

358. Air Valves are the subject of Rensselaer Bulletin Q in which Air Release, as well as Air and Vacuum, types are described. Address: Rensselaer Valve Co., Troy, N. Y.

Analysis of Water

360. "Methods of Analyzing Water for Municipal and Industrial Use" is an excellent 94 page booklet with many useful tables and formulas. Sent on request by Solvay Sales Corp., 40 Rector St., New York 6, N. Y.

Activation and Aeration

367. A valuable booklet on porous diffuser plates and tubes for sewage treatment plants. Covers permeability, porosity, pore size and pressure loss data, with curves. Also information on installations, with sketches and pictures, specifications, methods of cleaning and studies in permeability. 20 pp. illustrated. Sent on request to Norton Company, Worcester 6, Mass.

Blowers

370. All interested in low cost air for sewage disposal will want a copy of this catalog describing operating principles and specifications of Roots-Connersville Aerating Blowers. Write to Roots-Connersville Blower Corp., 301 Valley Ave., Connersville, Ind.

Bodies, Special Truck

375. Gar Wood Hoists, and Bodies for every requirement including special bodies for sanitary refuse collection and for street sprinkling are illustrated and described in new catalog issued by Gar Wood Industries, 7924 Riopelle St., Detroit, Mich.

Chlorinators, Portable

379. Complete data on new portable chlorinator designed to meet emergency calls quickly and efficiently. Write Wallace & Tiernan Co., Inc., Newark 1, N. J.

380. "Emergency Sterilization Equipment," a new bulletin describing the advantages of Dual Drive Chlor-O-Feeders which can serve as either a permanent chemical feeder or as a portable emergency chlorinator. Order from Proportioneers, Inc., 96 Codding St., Providence 1, R. I.

Cleaning Water Mains

383. Water main cleaning by the National Method is title of 4-page folder describing methods and results obtained, with full data. National Water Main Cleaning Co., 30 Church St., New York 7, N. Y.

Cleaning Sewers With Own Forces

386. 32-page illustrated booklet explains how a city can clean its sewers and culverts with its own forces using the up-to-date Flexible Sewer Rod equipment. Illustrates and describes all necessary equipment. Issued by Flexible Sewer Rod Equipment Co 9059 Venice Boul., Los Angeles 34, Calif.

387. Literature illustrating how cities, towns and villages using OK Champion Sewer Cleaners are doing a complete sewer cleaning job from street level. Three sizes of machines available in addition to full line of sewer rods and accessories. Issued by Champion Corporation, 4752 Sheffield Avenue, Hammond, Indiana.

Consulting Engineers

389. "Who, What, Why" outlines briefly the functions of the consulting chemist and chemical engineer. Covers various methods of cooperation, on different types of problems, with industry, with attorneys and with individuals. Foster D. Snell, Inc., 305 Washington St., Brooklyn, N. Y., will send a copy on request.

Feeders, Chlorine, Amonia and Chemical

392. For chlorinating water supplies, sewage plants, swimming pools and feeding practically any chemical used in sanitation treatment of water and sewage. Flow of water controls dosage of chemical; reagent feed is immediately adjustable. Starts and stops automatically. Literature from % Proportioneers. Inc. % 96 Codding St., Providence 1, R. I.

393. New circular describes and illustrates the Var-I-Feeder, a new portable chemical feeder for water main sterilization, military use or other chemical treatment. Write Chem-Feeds, Inc., 77 Reservoir Ave., Providence, R. I.

394. Everson Sterelators for all kinds of chemical feeding in stationary and portable models are described in new bulletins issued by Everson Manufacturing Co., 214 West Huron St., Chicago 1, Ill.

399. Pulsafeeders. A flow-proportional liquid chemical feeder, reciprocating type, fluid motor driven. Operating parts completely isolated from the chemical being fed. Micrometer adjustment. For feeding against high or low pressure. Wilson Chemical Feeders, Inc., 211 Clinton St., Buffalo 4, N. Y.

Filters

402. How to increase the capacity of filters through use of Anthrafilt and complete data on use of Anthrafilt for filters and sludge beds is contained in a revised pocket Manual issued by Anthracite Equipment Corp. For free copy write H. G. Turner, State College, Pa.

Fire Hydrants

405. Specifications for standard AWWA fire hydrants with helpful instructions for ordering, installing, repairing, lengthening and using. Issued by M & H Valve & Fittings Co., Anniston, Ala.

406. See listing No. 436.

407. Fire hydrants which are flood-proof, easy to operate and service are described in Rensselaer Bulletin W., formerly known as "Coreys." Address: Rensselaer Valve Co., Troy, N. Y.

Flow Meters

409. The primary devices for flow measurement—the orifice, the pilot tube, the venturi meter and others—and the application to them of the Simplex meter are described in a useful 24-page booklet (42A). Simplex Valve and Meter Co., 6750 Upland St., Philadelphia 42, Pa.

Gas Holders and Digesters

411. Digesters and Gas Holders for efficient collection and storage of sewage gas are described in an interesting illustrated booklet issued by Graver Tank & Mfg. Co., 332 South Michigan Ave., Chicago 4, Ill.

Gates, Valves, Hydrants

413. Gate, flap and check valves; floor stands and fittings. New catalog No. M gives detail information with dimensions for all types of new full line. M. & H. Valve & Fittings Co., Anniston, Ala.

415. See listing No. 436.

416. Check valves of the Clear-Way, Quiet-Closing type which eliminate "Slam" are described in Rensselaer Bulletin V. Made in expanding outlet type, as well as straight-thru type, for bolting direct to pump discharge. Address: Rensselaer Valve Co., Troy, N. Y.

417. Rensselaer Gate Valves of high tensile strength, corrosion resistant iron are described in Rensselaer Bulletin X. Address Rensselaer Valve Vo., Troy, N. Y.

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Meters, Venturi

432. New bulletin illustrates Builders Air Relay system of transmission for the Venturi Meter which is particularly useful for liquids containing suspended solids like sewage. Eliminates corroson, clogged pipes, etc. Write Builders-Providence, Inc., 9 Codding St., Providence 1, R. I.

433. "The Selection of Main Line Meters," a highly informative and useful presentation prepared by a competent engineer, J. C. Thoresen, describes forms of differential producers and quickly solves typical problems with the use of graphic charts. Write Builders-Providence, Inc., 9 Codding St., Providence 1, R. I.

Meters, Water

434. Six types of iron case cold water meters built for the duration, but to last for years are illustrated and described fully in folder issued by Pittsburgh Equitable Meter Co., 400 No. Lexington Ave., Pittsburgh 8, Pa.

Pipe, Cast Iron

435. Handbook of Universal Cast Iron Pipe and Fittings, pocket size, 104 pages, illustrated, including 14 pages of useful reference tables and data. Sent by The Central Foundry Co., 386 Fourth Ave., New York 16, New York.

436. Cast iron pipe and fittings for water, gas, sewer and industrial service. Super-deLavaud centrifugally-cast and pit-cast pipe. Bell-and-spigot, U. S. Joint, flanged or flexible joints can be furnished to suit requirements. Write U. S. Pipe and Foundry Co., Burlington, N. J.

437. "Cast Iron Pipe and Fittings" is a well illustrated 44 page catalog giving full specifications for their complete line of Sand Spun Centrifugal Pipe, Fire Hydrants, Gate Valves, Special Castings, etc. Will be sent promptly by R. D. Wood Co., 400 Chestnut St., Philadelphia 5, Pa.

438. McWane Precaulked Joint Cast Iron Pipe, in all sizes from 1¼ through 12 inches for water and sewage, equipped with various type of factory-made joints, as well as B. & S. joints. Illustrated booklet issued by McWane Cast Iron Pipe Co., Birmingham, Ala.

Pipe, Lock Joint

440. Lock Joint Reinforced Concrete Sewer Pipe. Pressure Pipe, Culvert Pipe, Centrifugal Pipe and Subaqueous Pipe is described and illustrated in bulletins available from Lock Joint Pipe Co., Ampere, N. J.

Pipe, Transite

442. Two new illustrated booklets, "Transite Pressure Pipe" and "Transite Sewer Pipe" deal with methods of cutting costs of installation and maintenance of pipe lines and summarize advantages resulting from use of Transite pipes. Sent promptly by Johns-Manville Corp., 22 East 40th St., New York 16, N. Y.

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443. Bellmaster Joints for simpler, faster, easier joining of cast iron pipe are illustrated in a new folder that gives full data on this self-contained mechanical joint. Write Dresser Mfg. Co., Bradford, Pa.

Pipe Joints Sewer

444. How to make a better sewer pipe joint of cement—tight, minimizing root intrusion, better alignment of joint. Permits making joints in water-bearing trenches. General instructions issued by L. A. Weston, Adams, Mass.

Pipe Joint Compounds

446. The uses of Tegul-Mineralead for bell and spigot pipe and G-K Sewer Joint compound are described in a 16-page illustrated booklet issued by Atlas Mineral Products Co., Mertztown, Pa. Includes useful tables for estimating quantities needed.

Pumps, Sludge

447. Carter Sludge Pumps are described in 8-page illustrated bulletin, including specifications and tables. Address: Ralph B. Carter Co., Hackensack, N. J.

448. Non-clogging, vertical or horizontal, dry pit or submerged; storm water and drainage pumps are described in several Bulletins; alo sump and bilge pumps. Dayton-Dowd Co., Quincy, Ill.

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450. Peerless pumps in a variety of types, with oil or water lubrication and any power drive, to pump water from any depth are described and illustrated in new literature that clearly shows their construction and special features. Write Peerless Pump Div., Food Machinery Corp., 301 W. Ave. at 26th St., Los Angeles 31, Calif.

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452. Centrifugal Pumps of various designs—single-stage, double-suction, split casing; single-stage single-suction; two-stage opposed impeller; three-stage; high-pressure; fire pumps; close-coupled. A bulletin for each type. Dayton-Dowd Co., Quincy, Ill.

Meter Setting and Testing

454. The most complete catalog we have seen on setting and testing equipment for water meters—exquisitely printed and illustrated 48-page booklet you should have a copy of. Ask Ford Meter Box Co., Wabash, Ind.

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456. Be assured of uninterrupted, constant automatic removal of screenings. Folder 1587 tells how. Gives some of the outstanding advantages of "Straightline Bar Screens" (Vertical and Inclined types). Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia 40, Pa.

Sludge Drying and Incineration

458. "Disposal of Municipal Refuse." Complete specifications and description including suggested form of proposal; form of guarantees; statements and approval sheet for comparing bids with diagramatic outline of various plant designs. 48 pages. Address: Morse Boulger Destructor Co., 205-P East 42nd St., New York 17, N. Y.

459. Recuperator tubes made from Silicon Carbide and "Fireclay" Corebusters for maximum efficiency are described and illustrated in bulletin No. 11 issued by Fitch Recuperator Co., Plainfield National Bank Bldg., Plainfield, N. J.

460. Nichols Herreshoff incinerator for complete disposal of sewage solids and industrial wastes—a new booklet illustrates and explains how this Nichols incinerator works. Pictures recent installations. Write Nichols Engineering and Research Corp., 60 Wall Tower, New York 5, N. Y.

Softening

462. This folder explains the process of Zeolite water softening and describes and illustrates the full line of equipment for that purpose made by the Graver Tank & Mfg. Co., 332 So. Michigan Ave., Chicago 4, Ill. Includes flow charts, tables and other valuable data. Write for a copy of this instructive folder.

463. Water Softening. The use of the Spaulding Precipitator to obtain maximum efficiency and economy in water softening is described in a technical booklet. Permutit Co., 330 W. 42nd St., New York 18, N. Y.

Sprinkling Filters

466. Design data on sprinkling filters of Separate Nozzle Field and Common Nozzle Field design as well as complete data on single and twin dosing tanks, and the various siphons used in them, for apportioning sewage to nozzles. Many time-saving charts and tables. Write Pacific Flush Tank Co., 4241 Ravenswood Ave., Chicago 13, Ill.

Swimming Pools

468. Data and complete information on swimming pool filters and recirculation plants; also on water filters and filtration equipment. For data prices, plans, etc., write Roberts Filter Mfg. Co., 640 Columbia Ave., Darby, Pa.

Taste and Odor Control

470. "Taste and Odor Control in Water Purification" is an excellent 92-page, illustrated booklet covering sources of taste and odor pollution in water supplies and outlining the various methods of treatment now in use. Every water works department should have a copy. Write Industrial Chemical Sales Div., 230 Park Ave., New York 17, N. Y.

471. Technical pub. No. 207 issued by Wallace & Tiernan Co., Inc., Newark 1, N. J., describes in detail taste and odor control of water with BREAK-POINT Chlorination, a method of discovering the point at which many causes of taste may be removed by chlorination with little or no increase in residual chlorine. Sent free to any operator requesting it.

Treatment

475. Three types of clarifiers for sewage treatment are illustrated and described in a new bulletin issued by Graver Tank & Mfg. Co., 332 South Michigan Ave., Chicago 4, Ill.

476. "Safe Sanitation for a Nation," an interesting booklet containing thumbnail descriptions of the different pieces of P.F.T. equipment for sewage treatment. Includes photos of various installations and complete list of literature available from this company. Write Pacific Flush Tank Co., 4241 Ravenswood Ave., Chicago 13, Ill.

477. All-steel Rotary Distributors, correctly designed for the small and medium sized sewage plants, are the subject of a new, well illustrated booklet issued by Graver Tank & Mfg. Co., 332 South Michigan Ave., Chicago 4, Ill. This booklet also covers distributors for various types of high-rate trickling filters.

478. New booklet (No. 1642 on Link-Belt Circuline Collectors for Settling Tanks contains excellent pictures; drawings of installations, sanitary engineering data and design details. Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia 40, Pa.

479. New 16-page illustrated catalog No. 1742 on Straightline Collectors for the efficient, continuous removal of sludge from rectangular tanks at sewerage and water plants. Contains layout drawings, installation pictures, and capacity tables. Address Link-Belt Co., 2045 West Hunting Park Ave., Philadelphia 40, Pa.

480. New illustrated folder (1942) on Straightline apparatus for the removal and washing of grit and detritus from rectangular grit chambers. Address: Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia 40, Pa.

481. "Sedimentation with Dorr Clarifiers" is a complete 36-page illustrated catalog with useful design data. Ask The Dorr Company, 570 Lexington Ave., New York 22, N. Y.

483. A combination mechanical clarifier and mechanical digester, The Dorr Clarigester, is explained and illustrated in a bulletin issued by The Dorr Company, 570 Lexington Ave., New York 22, N. Y.

484. Preflocculation without chemicals with the Dorrco Clariflocculator in a single structure is the subject of a new booklet issued by The Dorr Company, 570 Lexington Ave., New York 22, N. Y.

485. Dorrco Monorake for existing rectangular sedimentation tanks, open or closed, is described and illustrated in a new catalog sent on request. The Dorr Co., 570 Lexington Ave., New York 22, N. Y.

487. The complete line of Jeffrey equipment for water, sewage and industrial wastes treatment is illustrated and described in a handsome, new, 40-page catalog just issued by The Jeffrey Mfg. Co., 947-99 North Fourth St., Columbus 16, Ohio.

488. "Packaged" Sewage Treatment Plants, specifically developed for small communities—100 to 3,000 population. Write for full description and actual operating data for this type of plant. Chicago Pump Co., 2438 Wolfram St., Chicago 18, Ill.

489. "Carter Controlled Flocculation" is title of illustrated folder available on request from Ralph B. Carter Co., Hackensack, N. J.

Underdrains, Trickling Filter

492. Illustrated bulletin describes the Natco Unifilter block of glazed, hard burned clay for underdraining filter beds. Write National Fireproofing Corp., Pittsburgh 12, Pa., for free copy.

Valves (See Gates, Air Release, etc.)

Water Treatment

495. If you have a water conditioning problem of any kind, write Graver Tank & Mfg. Co., 332 So. Michigan Ave., Chicago 4, Ill., who manufacture all types of conditioning equipment and will be pleased to make recommendations.

496. "Use of copper sulphate in water treatment plants" titles informative booklet, with valuable data on chemicals, dosage, etc. Write Tennessee Corporation, Atlanta 1, Ga.

497. Ferri-floc Ferric Sulphate — a new, valuable booklet on coagulation for water and sewage treatment plants. Write Tennessee Corporation, Atlanta 1, Ga.

Water Service Devices

500. Data on anti-freeze outdoor drinking fountains, hydrants, street washers, etc., will be sent promptly on request to Murdock Mfg. & Supply Co., 426 Plum St., Cincinnati 2, Ohio.

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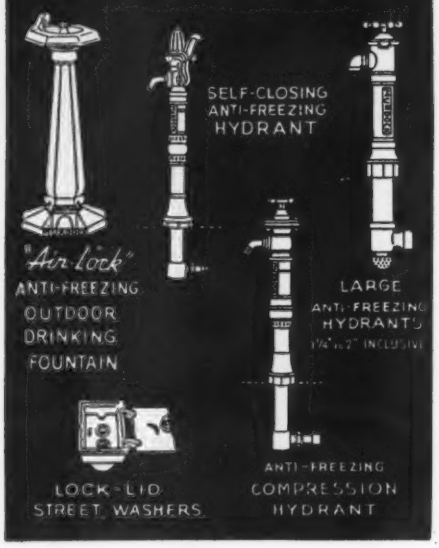

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Bulletin 36 gives full details of Lakeside's zeolite water treating plants.

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Vol. 75 No. 6

A. PRESCOTT FOLWELL, Editor

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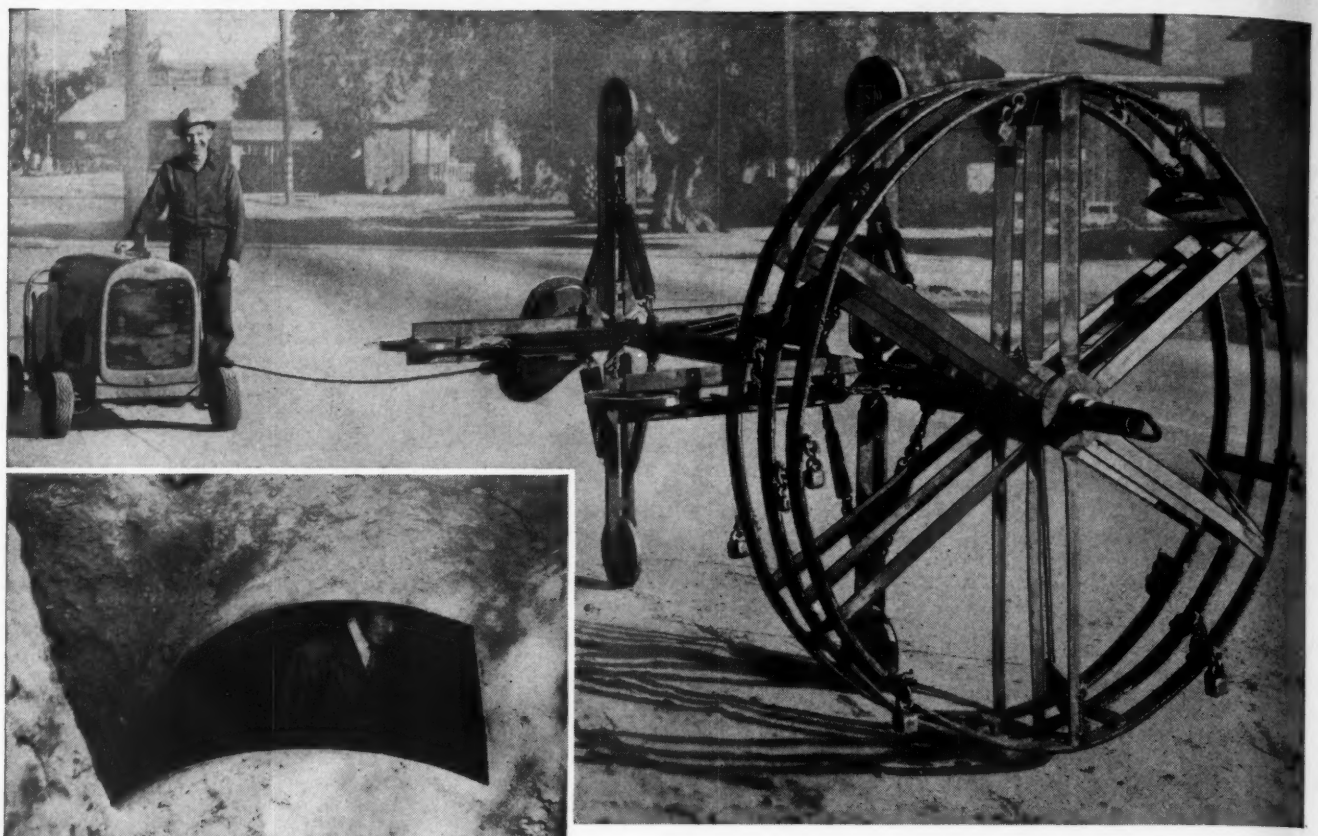

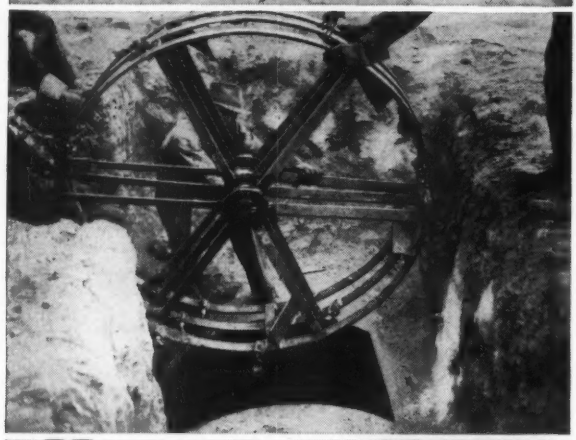

72-Inch Trunk Line Cleaned by FLEXIBLE

The 72-inch propeller-type chain head auger illustrated above was especially built for cleaning a 72-inch riveted steel pipe serving as a trunk line for the Los Angeles water system.

Illustrations at the left show the opening cut into the pipe, inserting the auger and entering the guide.

Below is shown the inside of the line after it was cleaned ready for placing the cement lining. Cement lining was done by American Pipe and Construction Co.

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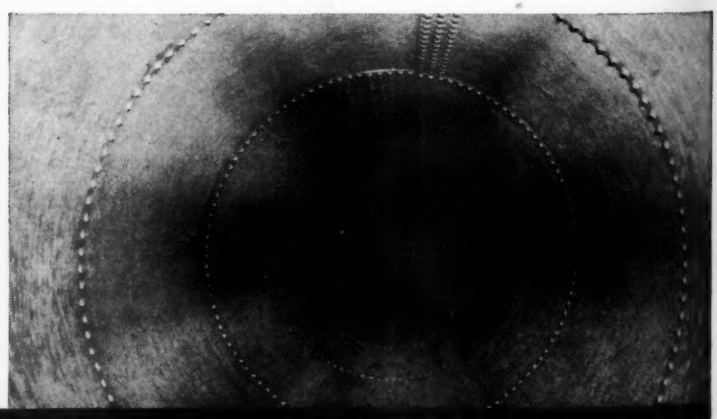

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